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Africa Research in Sustainable Intensification for the Next Generation - West Africa

Research in sustainable intensification of cereal-based farming systems in the Guinea-Sudan-Savanna of West Africa

**2017 Research Year Work Plan - Ghana**

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The Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government’s Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads an associated project on monitoring, evaluation and impact assessment.

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| **Partners and their responsibilities** | | |
| **Name** | **Acronym** | **Role/responsibility** |
| **Government Ministries & Entities** |  |  |
| Ministry of Food and Agriculture | MoFA | Scaling-out SI technologies and establishment of R4D platforms |
| Ghana Health Services | GHS | Household nutrition R4D with UDS and IITA |
| Grains and Legumes Development Board | GLDB | Production of foundation seeds |
| Veterinary Services Division | VSD | Animal health and capacity building of community health workers |
| Women in Agriculture Development | WIAD | To improve lives and working conditions of rural households |
|  |  |  |
| **Academic/National Research Institutions** |  |  |
| Animal Research Institute | ARI | R4D on livestock production (sheep and goats) with ILRI |
| Crops Research Institute | CRI | Breeder seed of improved cereals and legumes |
| Kwame Nkrumah University of Science and Technology | KNUST | Graduate student training and R4D on rural pig production |
| Savanna Agricultural Research Institute | SARI | R4D on cereal-legume-veg. systems with IITA, ICRISAT and WorldVeg |
| Soil Research Institute | SRI | R4D on integrated soil fertility management with IITA |
| Science and Technology Policy Research Institute | STEPRI | Policy and institutional research |
| University for Development Studies | UDS | Graduate training and R4D on rural poultry and pig production |
| Water Research Institute | WRI | Research on water management |
|  |  |  |
| **Non-Governmental organizations & research institutions** |  |  |
| Adventist Development and Relief Agency (ADRA-Ghana) | ADRA | Scaling-up of technologies and linkages with community based organizations |
| Association of Church-based Development NGOs | ACDEP | Scaling-up of proven technologies |
| Care Ghana | CARE | Dissemination of technologies |
| Canada Funds for Children | CFC | Dissemination of technologies and linkages with youth and women's groups |
| Catholic Relief Services | CRS | Dissemination of technologies |
| Grameen Foundation | Grameen | Promoting farmers' cooperatives and linking farmers to financial services |
| International Crops Research Institute for the Semi-arid Tropics | ICRISAT | Sorghum/millet-groundnut R4D with IITA and SARI |
| International Food Policy Research Institute | IFPRI | Lead site selection, baseline survey and monitoring and evaluation |
| International Institute of Tropical Agriculture | IITA | Overall project coordination and R4D research on cereal-legumes |
| International Livestock Research Institute | ILRI | Lead R4D on ruminants in Ghana and natural resources governance in Mali |
| Institute for Scientific and Technological Information | INSTI | Organize training and publish project document with IITA |
| International Water Management Institute | IWMI | Lead R4D on water management |
| Wageningen University and Research, The Netherlands | WUR | R4D on farming systems characterization and graduate training |
|  |  |  |
| **Private organizations and development projects** |  |  |
| AMSIG Marketing Company | AMSIG | Linking farmers to markets |
| Agricultural Development & Value Chain Enhancement Program | ADVANCE II | Assist with market linkages, joint demonstration of technologies |
| Agricultural Technology Transfer Project | ATT | Assist with the introduction of new labor-saving technologies |
| Farm Radio International | FRI | Radio programs to disseminate technologies |
| Food Security Through Cooperatives in Northern Ghana | FOSTERING | Promoting farmers' cooperatives and linking farmers to financial services |
| Resilience in Northern Ghana Project | RING | Joint activities in nutrition and small ruminant production |
| Seed Producers Association of Ghana | SeedPAG | Production of certified seeds and training on seed production |

**Summary**

The Africa RISING West Africa (WA) project is being implemented by multi-disciplinary research teams and development partners from the public and private sectors in collaboration with farmers and community-based organizations in northern Ghana and southern Mali.

This document presents the work plans for the 2017 research year for Ghana. The work plans are mapped under the four Outcomes in the Phase 2 project log frame (See Table 1 below). Nine activity protocols are presented – four for Outcome 1; two each for Outcomes 2 and 3; and one for Outcome 4. The nutrition activities are integrated with the livestock and vegetable activities in protocol GH211-17 under Outcome 2 in response to the recommendation of the USAID-commissioned external evaluation team.

Gender mainstreaming, capacity building and knowledge exchange and dissemination are embedded in all activity protocols. Linkages between activities are presented in each activity protocol. Publication of research results and better communication among research teams within and across countries will be a major focus.

**1. Background**

Phase 1 (1 October 2012 - 30 September 2016) of the USAID-funded Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) project in West Africa (WA) was implemented in 25 intervention communities in northern Ghana and 9 villages in the Bougouni and Koutialia districts of the Sikkaso Region in southern Mali under the *title 'Sustainable Intensification of Key Farming Systems in the Guinea-Sudano-Sahelian Zone of West Africa'*. Research activities under Phase 1 were organized around 3 research outputs (ROs), namely: 1) Situation analysis and program-wide synthesis (RO1); 2) Integrated Systems Improvement (RO2) and 3) Scaling and Delivery (RO3). Capacity building and gender were cross-cutting.

Phase 2 (1 October 2016 - 30 September 2021) of the WA project was launched in February 2017. The workplan is organized around 21 activities under 11 outputs to achieve four outcomes (Table 1). Implementation will be guided by achievements and lessons from Phase 1. There will, however, be a shift in approach from Research-for-Development (R-4-D) in Phase 1, to Research-in-Development (R-in-D) in Phase 2.

Technological packages and/or practices validated in Phase 1 (see Table 2) will be scaled out targeting agro-ecosystems and socio-economic circumstances defined by the sustainable intensification (SI) domains - productive, economic, social, human and environmental. Linkages will be established with research and development partners to undertake both generic and back-stopping research. The generic research aims at completing the loose ends of research on the SI innovations in Phase 2 plus any other emerging issues. The back-stopping research will address researchable issues emerging from the scaling-out of SI innovations with the development partners.

Phase 2 will also explore new research areas emerging from Phase 1 experiences and feedback by research and development partners, notably, using results from farming systems analyses and farm types to inform research targeting and technology dissemination; post-harvest management and value addition; nutrition sensitive agriculture; labour-saving mechanization solutions for small-scale farmers; and climate-smart agriculture. The project will also develop the following research and development strategy documents: 1) a livestock strategy to increase the impact of livestock-related activities, especially those on small ruminants, poultry and pigs; and a nutrition strategy to harmonize nutrition-related activities with the crop and livestock activities, as well as with national nutrition approaches. It will engage in purposeful inclusion of gender and youth concerns; and develop more rigorous and quantitative approaches for measuring diffusion and early adoption of SI technologies.

This document presents the work plan for Ghana for the 2017 research year. The work plan for Mali for the same period is presented in a separate document.

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| **Table 1:** Outcomes, outputs and activities of the Africa RISING West Africa project Phase 2 | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, and profitable and sustainably intensified crop-livestock systems linked to markets. | |
| Output 1.1: Research products for more productive, intensive, diverse, profitable and resilient crop (cereals, legumes, and vegetables); livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners. | Activity 1.1.1: Test and disseminate a combination of climate-smart crop varieties and agronomic practices to increase and sustain food and feed production.  Activity 1.1.2: Test and disseminate a combination of improved breeds, housing, feeding, health and breeding practices to intensify rearing of livestock (sheep, goat, pig, and poultry) for meat, egg and milk production.  Activity 1.1.3: Test and disseminate integrated crop-livestock-soil and agroforestry systems to increase and sustain productivity and reduce risk. |
| Output 1.2: Integrated management practices and innovations to improve and sustain productivity and ecosystems services of the soil, land, water and vegetation resources are developed and disseminated with farmers and development partners in the intervention communities. | Activity 1.2.1: Test and disseminate land, soil and integrated land-soil technologies and practices to improve and sustain productivity and ecosystems services at the farm and landscape/watershed levels.  Activity 1.2.2: Test and promote water management technologies and practices to increase water productivity in the small-scale crop-livestock farming systems under rain fed and irrigated conditions.  Activity 1.2.3: Test and promote integrated soil fertility and integrated pest management technologies and practices to increase and sustain productivity and reduce risk. |
| Output 1.3: Labor-saving and gender-sensitive technologies in target areas to reduce drudgery while increasing labor efficiency in the production cycle delivered. | Activity 1.3.1: Train local partners on appropriate use of drudgery-reducing technology delivery.  Activity 1.3.2: Introduce, test and adapt existing pre-harvest small-scale mechanization options to farmers and partners in the intervention communities. |
| Outcome 2: More farmers and farm families are adopting technologies and practices to improve nutrition, food and feed safety, post-harvest handling and value addition. | |
| Output 2.1: Improved technologies, innovations, practices and habits to increase production and consumption of safe diverse and more nutritious food for farm families, especially by women and children developed and disseminated in partnership with research and development partners. | Activity 2.1.1: Develop a nutrition strategy to harmonize the nutrition activities with national nutrition approaches and link them to the crop and livestock activities.  Activity 2.1.2: Train farm families, especially women to produce and consume diverse and more nutritious food.  Activity 2.1.3: Use nutrition focused activities as an entry point for greater involvement of younger women and the youth in the production and consumption of diverse and more nutritious foods. |
| Output 2.2: Postharvest technologies and practices to provide options for the food, and feed sectors are tested and disseminated to farmers, through researchers, extension staff, and development partners. | Activity 2.2.1: Introduce, evaluate, adapt and disseminate existing postharvest technologies and practices.  Activity 2.2.2: Build capacity of farm families to reduce postharvest losses. |
| Outcome 3: Farmers and other value chain actors have greater and equitable access to production assets and markets (input and output) through enabling institutions and policies. | |
| Output 3.1: Enabling policies and institutional arrangements to increase participation of farm families, especially women and youth in the output and input markets and decision-making are advocated for implementation by national governments, policy makers and development partners. | Activity 3.1.1: Review existing policies and institutional arrangements affecting equitable access to production assets and markets.  Activity 3.1.2: Assess the level of inclusiveness of women and the youth along crop and livestock value chains.  Activity 3.1.3: Advocate enabling policies and institutional arrangements to increase participation of farm families, especially women and youth in the output and input markets. |
| Output 3.2: Options to expand accessibility of production assets and increase participation in house-hold decision-making by disaggregated groups by gender. | Activity 3.2.1: Identify constraints to, and opportunities for increasing women and youth access to production assets in the target area. |
| Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI, technologies, innovations and practices. | |
| Output 4.1: Alliances and effective partnerships developed between farmers, local communities, and research and development agents in the public and private sectors to enable the release, dissemination, and adoption of proven technologies and practices to scale. | Activity 4.1.1: Conduct cost-benefit and gender analysis coupled with other socio-economic analyses to identify and quantify adoption constraints and opportunities for different farmer contexts.  Activity 4.1.2: Map and assess relevant stakeholders to establish dialogue for the exploration of mutual synergies for scaling delivery of validated technologies.  Activity 4.1.3: Leverage/link and integrate (engagement and outreach) with existent initiatives including Government extension systems to support and encourage the delivery pathways. |
| Output 4.2: Gender-sensitive decision support tools to assess technology-associated risks and opportunities are available for use by project partners. | Activity 4.2.1: Identify and communicate gender-sensitive decision support tools in the context of different farm typologies. |
| Output 4.3: An updated framework for monitoring technology adoption to be used by the project team and scaling partners available and accessible | Activity 4.3.1: Monitor and report technologies and their associated beneficiaries or farmers exposed to the innovations using the tools developed by IFPRI.  Activity 4.3.2: Make these reports available on the Africa RISING repositories. |
| Output 4.4: Knowledge sharing centers (physical structures) and learning alliances are developed within existing local and regional institutions | Activity 4.4.1: Establish knowledge-sharing and learning alliances among scaling actors. |

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| **Table 2:** List of validated technologies ready for promotion through development partners in the Northern, Upper East and Upper West regions of Ghana | |
| Broad category | Validated flagship technology |
| Introduction of new crops and varieties to overcome existing biotic and abiotic stresses and improve productivity per unit land area | New varieties – drought tolerant maize, rice, aflatoxin resistant groundnut, sorghum hybrids, early-maturing cowpea, dual-purpose cowpea, short-duration soybean, medium soybean, high yielding and disease resistant varieties of vegetables (okra, roselle, tomato, eggplant and pepper) |
| Agronomic practices to improve grain and fodder yield per unit land area, and improve soil nitrogen | Cereal-legume intercropping  Cereal-legume rotations  Dual-purpose food legumes  Cereal-vegetable intercropping |
| Integrated soil fertility management as a cost-effective approach to replenish soil fertility | Optimized N and P fertilizer rates  Fertilizer micro-dozing  Livestock corralling for manure/urine  Cereal-legume rotations  Cereal-legume intercropping |
| Improved livestock feeds and feeding, housing, health and breeding management packages | Sheep/goat flock feeding package  Sheep/goat health package  Housing and feeding for poultry  Guinea fowl hatching and brooding management  Stover quality improvement |
| Introduction of pre- and post-harvest technologies to reduce food waste and improve food safety | Storage – PICS bags, plastic drums  Aflasafe application |

**2. Planned work**

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| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 1).* | | | | | | | | | | | |
| **2017 Africa RISING West Africa Activity Protocol – Outcome 1: GH111A-17** | | | | | | | | | | | |
| *Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainably intensified crop-livestock systems linked to markets.* | | | | | | | | | | | |
| a. Output: 1.1 | | | Research will identify more productive, intensive, diverse, profitable and resilient crops (cereals, legumes, vegetables), livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems and will disseminate these to the farmers through development partners in the intervention communities | | | | | | | | |
| b. Activity: 1.1.1 | | | Test a combination of climate-smart crop varieties and agronomic practices to increase and sustain food and feed production | | | | | | | | |
| c. Sub-activity: GH111A-17 | | | Test, disseminate and adapt crop, livestock and integrated crop-livestock technologies and practices to increase and sustain productivity of smallholder crop-livestock farming systems | | | | | | | | |
| d. Research team | | | | | | | | | | | |
| Name | | | | | Institution | | Role | | | | |
| Asamoah Larbi | | | | | IITA | | Leader, crop-livestock systems, graduate training | | | | |
| Abdul Rahman Nurudeen | | | | | IITA | | Cereal agronomy and plant nutrition | | | | |
| Bekele Kotu | | | | | IITA | | Economic analysis | | | | |
| Shaibu Melon | | | | | IITA | | Economic analysis | | | | |
| Gundula Fischer | | | | | IITA | | Gender studies | | | | |
| Kipo Gimah | | | | | IITA | | Gender studies | | | | |
| Kofi Danso | | | | | IITA | | Post-harvest management | | | | |
| Terry Ansah | | | | | UDS | | Ruminant nutrition | | | | |
| Adda Wesseh | | | | | UDS | | Livestock nutritionist | | | | |
| Saaka Buah | | | | | SARI | | Plant nutrition and soil science | | | | |
| Jean-Baptiste Tignegre | | | | | WorldVeg | | Vegetable breeding | | | | |
| Zakaria Iddrisu | | | | | SeedPAG | | Seed production and training | | | | |
| Robert Asuboah | | | | | GLBD | | Foundation seed production | | | | |
| Obeng Asamoah | | | | | CRI | | Breeder seed production | | | | |
| Samuel Partey | | | | | CCAFS/ICRISAT | | Climate change adaptation and mitigation | | | | |
| Mathieu Ouedraogo | | | | | CCAFS/ICRISAT | | Participatory action research - climate change | | | | |
| Robert Zougmoré | | | | | CCAFS/ICRISAT | | Agronomy and soil research | | | | |
| Baloua Nebie | | | | | ICRISAT | | Sorghum and millet agronomy | | | | |
| Aboubacar Toure | | | | | ICRISAT | | Sorghum and millet agronomy | | | | |
|  | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | |
| Name | | | | Institute | | | | Degree | Start | End | |
|  | | | |  | | | |  |  |  | |
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|  |  | | | | | | | | | | |
| f. Location(s) | Northern (Tingoli, Cheyohi no. 2, Doku, Tibali), Upper East (Samboligo, Nyangua, Gia, Bonia), Upper West (Zanko, Guo, Goli, Goriyiri) regions | | | | | | | | | | |
| g. Start | June 2017 | | | | | | | | | | |
| h. End | March 2018 | | | | | | | | | | |
|  |  | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | |
| Small-scale crop-livestock farming systems predominate in the intervention communities of the Africa RISING project in the three northern regions of Ghana. Farmers grow cereals (e.g., maize, rice, millet and sorghum), legumes (e.g. groundnut, cowpea, soybean, Bambara, pigeon pea) and vegetables (roselle, okra, pepper onion, garden egg, tomato, amaranths, pumpkin) in pure or mixed stands. They raise livestock (cattle, sheep, goats, pigs and poultry) under extensive and semi-intensive systems for meat and milk for food, manure for crop production, cash, power for land cultivation and transport, with limited feed, shelter, health care, and breeding management. Total productivity of the integrated crop-livestock systems is generally low, partly due to weak integration of the crop and livestock enterprises and limited use of good agronomic and animal husbandry practices.  Crop yields on farmers’ fields are generally poor due to low and variable rainfall, drought, low and declining soil fertility, use of low yielding varieties, lack of quality seed of improved crop varieties and land preparation equipment, high cost of inputs and postharvest losses, labour constraints that lead to poor growing conditions (late sowing, sub-optimal plant populations, inadequate control of weeds, *Striga*, pests and diseases), and low use of organic or mineral fertilizers. Productivity of the animals is low due to inappropriate husbandry (feeding, health care, housing, and breeding) practices that result in high mortality rates. Farmers have limited access to veterinary services, and improved livestock breeds. Fallow land grazing and crop residues are the main feed resources for the livestock. Due to high human and livestock populations, fallow lands are overgrazed leading to degradation of the land, soil and vegetation resources.  In Phase 1, several interventions were tested in partnership with multiple partners including farmers and community-based organizations using the technology park approach. They included: testing and dissemination of improved crop varieties (drought and striga resistant, high yielding, short/medium/long duration multi-purpose crops); appropriate agronomic (planting density, cereal-legume-vegetable intercropping, crop diversification, and agro forestry) and animal husbandry (semi-intensive and intensive management, dry season feed supplementation, vaccination and deworming) practices, and ensuring better integration of the crop and livestock enterprises. Group and individual trainings and short courses were used to strengthen the capacities of the partners. Academic trainees at MSc and PhD levels were engaged to address important knowledge gaps and to build national research capacity. Limited studies were conducted to examine effects of cropping technologies on soils (nutrient depletion) and the interactions among soils, crops and livestock; simulation via crop-processed models to address systems stability and trade-offs, and production variability and risk assessment.  This protocol addresses crop-livestock-vegetable related issues in the Africa RISING West Africa Phase 2 project logframe, especially Activities 1.1.1, 1.1.2 and 1.1.3 (Table 1). The research activities for 2017 within this protocol focus on developing good agronomic practices to maximize production of food and feed from cereal-legume systems. The activities are: 1) variety and planting density effects on grain and fodder yield and quality of groundnut, and 2) leaf stripping to optimize grain and feed from maize-based cropping systems, 3) cowpea living mulch effect on weed control, soil properties and maize yield, 4) agronomic practices to maximize aflasafe use in maize and groundnut cropping systems, 5) intensifying and diversifying rainfed and irrigated vegetable production, and 6) Climate Smart Village approach to mainstream climate variability in the promotion of sustainable intensification innovations.  In response to the recommendations of the USAID-commissioned external evaluation team, Decision Support Systems will be used to match the agronomic technologies (fertilizer application, crop densities, planting dates, crop combinations) to soil and climatic conditions for sustainable intensification of the cropping systems, and to address production variability and risk in northern Ghana.  Knowledge transfer and scaling strategies will include: establishment of research-for-development plots to demonstrate technologies; participatory and joint learning approaches for technology testing, e.g., Community-based Technology Parks; development of media materials (posters, leaflets, films) for extension staff, farmers, etc.; organize exchange visits for farmers and researchers; training of trainers and hands on training for farmers.  Activities planned under this protocol relate to activities RT2-Gh-1 and RT2-Gh-2 of the 2015-2016 research year work plan under Phase 1. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **Sub-activity GH111A-1701: Variety and planting density effects on grain and fodder yield and quality of groundnut - Leader: Asamoah Larbi** | | | | | | | | | | | |
| Groundnut is the most important food and feed crop in West Africa. Grain and fodder yields are low due to limited use of improved varieties and inappropriate agronomic practices such as low planting densities. Consultations by the Groundnut Scaling and N2 Africa projects show that farmers use different planting densities for most of the improved varieties released over the past decade. Secondly, fodder yield and quality were not considered as selection criteria in the breeding programs. Therefore, a study was started in 2016 to test the hypothesis that variety and planting density significantly affect grain and haulm yields and quality, and weed population in fields of released groundnut varieties in northern Ghana. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | |
| 2.1 Determine the effect of plant density on groundnut yield | | | | | | | | | | | |
| 2.2 Evaluate adaptability and suitability of improved groundnut varieties to different agro-ecologies | | | | | | | | | | | |
| 2.3 Evaluate the effect of gender on yield of groundnut | | | | | | | | | | | |
| 2.4 Evaluate the effect of groundnut variety and plant density on the quantity and quality of groundnut fodder | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | |
| 3.1 How do different plant densities affect yields of groundnut? | | | | | | | | | | | |
| 3.3 How do improved groundnut varieties adapt to the different agro-ecologies? | | | | | | | | | | | |
| 3.4 How does gender affect groundnut yield? | | | | | | | | | | | |
| 3.5 How do feeding residues of different groundnut varieties to small ruminant affect their growth performance? | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | |
| The effect of 4 plant spacing (30 x 15, 45 x 15, 60 x 15, 75 x 15 cm) on grain and haulm yield of seven groundnut varieties (Chinese, Azivivi, Obolo, Yenyawoso, Manipinta, Samnut 22, Samnut 23) will be evaluated using a 4 x 7 factorial arrangement in a randomized block design in the technology parks and on selected farmers' field. A gender survey will be conducted to evaluate male and female preferences. Farmers’ field day will be organized. Cost benefit analysis will be compared.  The haulms will be analyzed for crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF) and in vitro organic matter digestibility (IVOMD). A feeding trial will be conducted on-farm and on-station with 6-10 sheep or goats per treatment to determine voluntary intake and growth performance. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | | | | | | Responsibility |
| 5.1 Grain and haulm yield | | | | | | | | | | | IITA |
| 5.2 Access to labor, timing and frequency of farm operations, decision making at farm level | | | | | | | | | | | IITA |
| 5.3 Determinants of fodder quality (CP, NDF, ADF), intake, digestibility, growth performance | | | | | | | | | | | UDS |
|  | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | |
| Deliverables | | | | | | Means of verification | | | End date | | |
| 6.1 Agronomic trial completed | | | | | | Field visit and project report | | | Dec. 2017 | | |
| 6.2 Gender survey conducted | | | | | | Field visit and project reports | | | Dec. 2017 | | |
| 6.3 Feeding trial completed | | | | | | Reports and project publication | | | Mar. 2018 | | |
| 6.4 Paper published: Variety and plant spacing effects on groundnut grain and fodder yields | | | | | | Field Crops Research | | | Mar. 2019 | | |
|  | | | | | | | | | | | |
| 7. Sustainable intensification indicators | | | | | | | | | | | |
| 7.1 Productivity | | Crop and livestock production at the plot and farm level | | | | | | | | | |
| 7.2 Environmental | | Vegetative cover and cropping intensity at plot level | | | | | | | | | |
| 7.3 Economic | | Profitability and input use efficiency at field and farm levels | | | | | | | | | |
| 7.4 Social | | Gender equity at farm and household levels | | | | | | | | | |
| 7.5 Human | | Food production and nutritious food production at plot and farm levels | | | | | | | | | |
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| **Sub-activity GH111A-1702: Leaf stripping to maximize food and feed yields from maize-based cropping systems - Leader: Asamoah Larbi** | | | | |
| Feed shortages during the cropping season constrain cattle, sheep, goat and pig production in small-scale crop-livestock systems. The lower leaves of cereals, especially maize can be stripped after tasseling or silking to provide feed during the cropping season without compromising the grain yield. The effect of stripping may vary with the maize maturity type. Quantitative information on such practice in northern Ghana and West Africa is limited. This study was started in the 2016 research year, second year data is required to confirm the first year results. | | | | |
|  | | | | |
| 2. Objectives | | | | |
| 2.1 Determine the effect of leaf stripping on grain and fodder yield of maize | | | | |
| 2.2 Evaluate gender preferences for leaf stripping | | | | |
| 2.3 Determine the feed value of stripped maize leaves | | | | |
|  | | | | |
| 3. Research questions | | | | |
| 3.1 How does leaf stripping and maize maturity type affect grain and fodder yields? | | | | |
| 3.3 What are gender preferences for maize leaf stripping? | | | | |
| 3.4 How does the maize maturity type affect the quality of stripped leaves? | | | | |
|  | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | |
| The effect of three levels of maize leaf stripping (no stripping, stripped at 50% tasseling and stripped at 50% silking) and maize maturity type (Extra-early: TZEE-W STR QPM C0; Early, Omankwa; Medium, Obatanpa) on grain and fodder yields of maize will be determined using a 3 x 3 factorial treatment arrangement in a randomized block design in the community-based technology parks and on selected farmers’ fields. A gender survey and farmers' field day will be conducted to evaluate male and female preferences.  The fodder will be analyzed for crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF) and in vitro organic matter digestibility (IVOMD). A feeding trial will be conducted on-farm and/or on-station with either sheep or goats to determine voluntary intake and growth performance. | | | | |
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| 5. Data to be collected and uploaded | | | | Responsibility |
| 5.1 Grain and haulm yield | | | | IITA |
| 5.2 Access to labor, timing and frequency of farm operations, decision making at farm level | | | | IITA |
| 5.3 Determinants of fodder quality (CP, NDF, ADF), intake, digestibility, growth performance | | | | UDS |
|  | | | | |
| 6. Milestones | | | | |
| Deliverables | | Means of verification | Date | |
| 6.1 Agronomic trial completed | | Field visit and project report | Dec. 2017 | |
| 6.2 Gender survey conducted | | Field visit and project reports | Mar. 2018 | |
| 6.3 Feeding trial completed | | Reports and project publication | Mar. 2018 | |
| 6.4 Paper: Leaf stripping effects on maize grain and fodder yields | | Experimental Agriculture | Mar. 2019 | |
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| 7. Sustainable intensification indicators | | | | |
| 7.1 Productivity | Crop and livestock production at the field and farm levels | | | |
| 7.2 Environmental | Vegetative cover, plant biodiversity and soil health at the plot level | | | |
| 7.3 Economic | Profitability and input use efficiency at the plot and farm levels | | | |
| 7.4 Social | Gender equity at the farm and household levels | | | |
| 7.5 Human | Food production and production of nutritious food at the field and farm levels | | | |
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| **Sub-activity GH111A-1703: Cowpea living mulch effect on weed control, soil properties and maize yield - Leader: Asamoah Larbi** | | | | |
| Maize (*Zea mays* L.) is a major cereal crop in West Africa, accounting for slightly over 20% of the gross domestic production in the sub-region (Manyong et al., 2000[[1]](#footnote-1)). Grain yields on farmers’ fields are low due to several biophysical and socio-economic factors, including low and erratic rainfall, low soil fertility, and weed infestation. Living mulch of legumes conserve nitrogen in grain crops, reduce soil erosion and weed pressure, and increase soil organic matter(Hartwig and Ammon, 2002[[2]](#footnote-2)). This study was planned to start during the 2015-2016 research year to test the hypothesis that cowpea living mulch can significantly improve soil properties, reduce weed infestation, and increase maize yield under the Guinea-Sudano savanna conditions of West Africa. However, it could not be implemented due to the late start of the rains. | | | | |
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| 2. Objectives | | | | |
| 2.1 Determine the effect of cowpea living mulch on weed population in a maize-cowpea cropping system | | | | |
| 2.2 Evaluate the effect of cowpea living mulch on soil properties in a maize-cowpea cropping system | | | | |
| 2.3 Determine the effect of cowpea living mulch on maize grain and fodder yields | | | | |
| 2.4 Evaluate the effect of gender on yield of maize under cowpea living mulch | | | | |
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| 3. Research questions | | | | |
| 3.1 How does cowpea living mulch affect weed control under maize production? | | | | |
| 3.3 How does cowpea living mulch affect soil moisture and temperature? | | | | |
| 3.4 How does cowpea living mulch affect maize yield? | | | | |
| 3.5 What are the preferences of male and female farmers for living mulch? | | | | |
|  | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | |
| 4.1 Agronomic design: Randomize complete block design (RCBD) | | | | |
| 4.2 Gender: Survey | | | | |
| 4.3 The effect of four levels of cowpea living mulch (No living mulch, cowpea and maize same day, cowpea one week after maize, Cowpea two weeks after maize) and maize maturity type (Extra-early: TZEE-W STR QPM C0; Early, Omankwa; Medium, Obatanpa) on weed control, soil characteristics and grain yields of maize will be determined using a 4 x 3 factorial treatment arrangement in a randomized block design. Trials will be conducted with farmers in the community parks and on selected farmers' fields. A gender survey and a farmers' field day will be conducted to evaluate male and female preferences. | | | | |
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| 5. Data to be collected and uploaded | | | Responsibility/Institute | |
| 5.1 Weed diversity and biomass, maize grain and fodder yields | | | IITA | |
| 5.2 Gender: access to labor, timing and frequency of farm operations, decision making at farm level | | | IITA | |
| 5.3 Soil characteristics (temperature, moisture, nutrients) | | | SRI | |
|  | | | | |
| 6. Milestones | | | | |
| Deliverables | | Means of verification | | Date |
| 6.1 Agronomic trial completed | | Field visit and annual reports | | Dec. 2017 |
| 6.2 Gender survey report | | Field visit and annual reports | | Dec. 2017 |
| 6.3 Paper published: Cowpea living-mulch effects on maize grain yield, vegetation cover and soil moisture dynamics | | Paper in peer reviewed workshop proceeding | | Mar. 2019 |
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| 7. Sustainable intensification indicators | | | | |
| 7.1 Productivity | Crop yield and the plot level | | | |
| 7.2 Environmental | Vegetative cover and soil health at the plot level | | | |
| 7.3 Economic | Profitability and input use efficiency at the plot and farm levels | | | |
| 7.4 Social | Gender equity at the farm and household levels | | | |
| 7.5 Human | Food production and nutritious food production at plot and farm level | | | |
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| **Sub-activity GH111A-1704: Intensify and diversify irrigated smallholder vegetable production systems - Leader: Jean-Baptiste Tignegre** | | | | |
| Rainfed and dry season irrigated vegetable (pepper, eggplant, and tomato) production in pure and/or mixed cereal-vegetable stands for food and cash are widespread in the intervention communities in Ghana. Limited access to seeds of improved varieties, water for dry season irrigation and information; and inappropriate agronomic practices (seeding rate, fertilization, disease control, pest management, etc.) are among the major constraints to production. Vegetable research in Phase 1 focused on limited varietal evaluation and assessment of various maize-vegetable cropping systems with limited community involvement. In Phase 2, varieties of known and little-known vegetable species and good agronomic practices will be evaluated under rainfed and irrigation conditions with farmers' interest groups in the Upper East and Northern regions. The vegetable activities will be related to the livestock and nutrition activities through promotion of home gardens to improve household dietary diversity and income (See protocol GH211-17).  Activities planned under this protocol are related to activity RT2-Gh-3 in the 2015-16 research year work plan of Phase 1. | | | | |
|  | | | | |
| 2. Objectives | | | | |
| 2.1 Evaluate varieties of known and little-known vegetable species under rainfed and irrigated conditions with farmers | | | | |
| 2.2 Evaluate good agronomic practices to intensify and diversity the small-scale rainfed and irrigated vegetable production | | | | |
| 2.3 Promote information and knowledge exchange among farmers | | | | |
|  | | | | |
| 3. Research questions/hypotheses | | | | |
| 3.1 Leaf and/or fruit production of varieties of known and little-known vegetable varieties will not differ significantly under rainfed and irrigation conditions. | | | | |
| 3.2 Good agronomic practices can significantly increase leaf and/or fruit yield of varieties of known and little-known vegetable species under rainfed and irrigated conditions. | | | | |
|  | | | | |
| 4. Procedures | | | | |
| **Sub-activity GH111A-1704-1: Identification of varieties of vegetable species adapted to northern Ghana under rain fed and irrigation - Leader: Jean-Baptiste Tignegre** | | | | |
| In the dry season, about 3 to 4 trials will be conducted at the Vegetable Hubs in the Upper East and Northern regions and on selected farmers' fields to test 5 to 10 varieties of tomato, pepper, African eggplant and onion to select high-yield and disease resistant varieties. A randomized block design with 4 to 6 replications will be used. Separate trials will be conducted for varieties of each species using farmers' variety will be used as control. Field days will be organized to document male and female farmers' preferences for the various treatments. | | | | |
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| **Sub-activity GH111A-1704-2: Leaf and fruit production of vegetable varieties under different N regimes and irrigation system - Leader: Jean-Baptiste Tignegre** | | | | |
| A 3 (tomato varieties - farmers' and two improved varieties) x 3 (N fertilizer applied as urea at 0, 30 and 60kg/ha) factorial treatment arrangement in a randomized complete block design with 3-4 replications will be conducted in the six Vegetable Hubs and farmers' fields. Separate trials will be conducted under drip irrigation. Similar trials will be conducted with pepper and African eggplant under drip irrigation. Field days will be organized to document male and female farmers' preferences for the various treatments. Farmers involved in the nutrition-sensitive agriculture activities (livestock + vegetable + nutrition) will benefit from varietal tests as home gardens. | | | | |
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| 5. Data to be collected and uploaded | | | | |
| 5.1 Days to 50% flowering | | | WorldVeg | |
| 5.2 Number of plants bearing fruits per plot; fruit yield (kg/ha) | | | WorldVeg | |
| 5.3 Leaf yield | | | WorldVeg | |
| 5.4. Gender preferences for vegetable varieties | | | | |
|  | | | | |
| 6. Milestones | | | | |
| Deliverables | | Means of verification | | Date |
| 6.1 Field trials established | | Field visit and project reports | | Aug. 2017 |
| 6.2. Database on vegetables | | Uploaded on CKAN | | Dec. 2017 |
| 6.3 Field days organized | | Field visit and project report | | Dec. 2017 |
| 6.4. Paper in workshop proceedings on Performance of vegetables varieties under irrigation' | | Paper available online or in a proceeding | | Dec. 2018 |
|  | | | | |
| 7. Sustainable intensification indicators | | | | |
| 7.1 Productivity | Crop yield and cropping intensity at the plot and farm levels | | | |
| 7.2 Environmental | Ground cover and water productivity at the plot level | | | |
| 7.3 Economic | Profitability and input use efficiency at the plot and farm levels | | | |
| 7.4 Social | Gender equity at the farm and household levels | | | |
| 7.5 Human | Nutritious food production at the plot and farm levels | | | |

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| **Sub-activity GH111A-1705: Climate Smart Village approach to mainstream climate variability in the promotion of sustainable intensification innovations - Leader: Mathieu Ouedraogo** | | | |
| Promotion of Climate Smart Agricultural (CSA) practices remains a global developmental agenda and one mainstream opportunity to mitigate climate change and sustain the productivity of agricultural systems. Considering this need, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) has developed the Climate-Smart Village (CSV) approach as a means to agricultural research for development (AR4D). It is an approach where CCAFS in partnership with rural communities and other stakeholders (NARS, NGOs, local authorities), tests & validates in an integrated manner, several climate-smart agricultural interventions that will be brought to scale. The CSV approach is founded on the principles of participatory action research for grounding research on appropriate and location/context-specific enabling conditions, generating greater evidence of CSA effectiveness in a real-life setting and facilitating co-development of scaling mechanisms towards landscapes, sub national and national levels. The CSV approach has six components - (1) CSA practices and technologies, (2) climate information services and insurance, (3) local and national public and private institutions, (4) national and sub national plans and policies, (5) farmers’ knowledge and (6) climate and ag-development finance. Each of the components involves members of the research team, meteorological services, local authorities and selected development partners. Since 2011, CCAFS has been using the CSV approach in West Africa (Ghana, Senegal, Mali, Niger and Burkina Faso) to test and validate several agricultural interventions with the participation of various local partners. In Ghana, substantial successes have been achieved over the past 4 years where through the CSV, climate information was used as an entry point for informing the choice of CSA technologies that have contributed to improved farm productivity and building resilient livelihoods for poor and marginal farmers. These successful technologies and practices include crop rotation (maize and cowpea), water conservation techniques (tie ridge), minimum or no tillage (with soybean and maize), application of combined mineral and organic fertilizer and use of drought tolerant varieties of crops.  In view of the priorities of Africa RISING, CCAFS will use its experiences in promoting and disseminating integrated crop-livestock-soil systems based on local climate variability for sustained productivity and reduced risk in the intervention communities. | | | |
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| 2. Objectives | | | |
| 2.1 Assess the local need for CSA based on climate, soil, crop, livestock and socio-economic factors | | | |
| 2.2 Promote the use of climate information as a basis for farm management decisions | | | |
| 2.3 Promote the adoption of CSA technologies and practices based on local needs for improved adaptive capacity to climate change and variability | | | |
| 2.4. Strengthen the capacity of farmers and extension agents in climate smart agriculture | | | |
|  | | | |
| 3. Research questions | | | |
| 3.1 What climate, soil, production and socio-economic factors inform the choice and use of the local agronomic practices? | | | |
| 3.2 How does provision and use of climate information services relate to farm productivity and livelihoods of smallholder farm communities based on choice of climate-smart crop varieties, livestock breeds, fodder species and agronomic and animal husbandry practices? | | | |
| 3.3 What factors constrain use and adoption of climate-smart crop varieties, livestock breeds, fodder species and farm practices (agronomic and animal husbandry) even with access to climate information services? | | | |
| 3.4 What combinations of climate-smart crop varieties, livestock breeds, fodder species and farm practices enhance the adaptive capacity of farmers? | | | |
|  | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | |
| 4.1 Baseline assessment of farmers’ vulnerability to climate risk and variability and their adaptation strategies to climate risk and variability. This will be followed by participatory identification and prioritization of climate-smart technologies, practices and services based on biophysical, socio-economic, gender, policy and institutional context; also considering possible synergies and trade-offs amongst individual activities. Thereafter, climate information services will be provided to farmers using climate forecast communication and the PICSA approach. Portfolios of climate-smart interventions (e.g. providing value-added weather services to farmers, building capacity in climate change adaptation and facilitating community partnerships for knowledge sharing) will then be evaluated. Capacities of stakeholders for the scaling up of climate-smart interventions through policies and institutions will be built, and scaled out to large areas through farm-to-farm approach. | | | |
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| 5. Data to be collected and uploaded | | | |
| 5.1 Socio-economic data (household livelihoods means, adaptation strategies, farmers’ perceptions) will be collected at household and community levels by CCAFS in partnership with SARI. | | | |
| 5.2 Historic weather information will be collected throughout the study | | | |
|  | | | |
| 6. Milestones | | | |
| Deliverables | | Means of verification | Date |
| 6.1 Local need of CSA based on climate, soil, crop, livestock and socio-economic factors assessed | | Baseline assessment report | Apr. 2017 |
| 6.2. Farmers and extension agents trained in climate change and CSA | | Training workshop report | Dec. 2017 |
|  | | | |
| 7. Sustainable intensification indicators | | | |
| 7.1 Productivity | Crop yield at household level | | |
| 7.2 Environmental |  | | |
| 7.3 Economic | Profitability and income diversification at the household level | | |
| 7.4 Social |  | | |
| 7.5 Human | Social cohesion at the community level | | |

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| 8. How will scaling be achieved? |
| Scaling will be achieved through strategic partnership with development partners. Knowledge transfer and scaling strategies will include: establishment of research-for-development plots to demonstrate technologies; participatory and joint learning approaches for technology testing, e.g., Community-based Technology Parks; development of media materials (posters, leaflets, films) for extension staff, farmers, etc.; organize exchange visits for farmers and researchers; training of trainers and hands on training for farmers. |
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| 9. How are the activities in this protocol linked to those of others? |
| Activities have links with those on vegetable and livestock production under protocol numbers: GH121-17, GH122-17 and GH221-17 |

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| 10. Budget (USD) | | | | |
| Budget Line | IITA | MOFA | WorldVeg | ICRISAT (CCAFS)/SARI |
| Personnel | 140,000 | 2,000 | 12,000 | 2,000 |
| Services | 120,000 | 6,000 | 4,000 | 6,000 |
| Supplies | 90,000 | 0 | 6,000 |  |
| Capital | 0 | 0 | 2,000 |  |
| Travel | 30,000 | 2,000 | 1,000 |  |
| Overhead | 0 | 0 | 5,000 | 2,000 |
| Total | 380,0001 | 10,0002 | 30,0003 | 10,0004 |
| 1Includes cost of staff, project offices, vehicle running and maintenance of the 25 intervention communities in the Northern (Tamale), Upper West (Wa) and the Upper East (Navrongo) regions. Includes 20,000 for graduate training training | | | | |
| 2 Allocated by IITA to MOFA | | | | |
| 3Amount for vegetable activities in the vegetable hubs in the Upper East (6) and Northern (1 hub) regions | | | | |
| 4Allocated to CCAFS for climate-smart agriculture activities through ICRISAT allocation | | | | |

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| **2017 Africa RISING West Africa Activity Protocol – Outcome 1: GH111B-17** | | | | | | | | | | |
| *Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainably intensified crop-livestock systems linked to markets.* | | | | | | | | | | |
| a. Output: 1.1 | | Research products for more productive, intensive, diverse, profitable and resilient crop (cereals, legumes, vegetables); livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities | | | | | | | | |
| b. Activity: 1.1.1 | | Test a combination of climate-smart crop varieties and agronomic practices to increase and sustain food and feed production | | | | | | | | |
| c. Sub-activity: GH111B-17 | | Finalize efficacy trials of aflasafe products used in maize and groundnut and continuation of aflasafe carry-over efficacy trials and registration of two aflasafe products with Ghana-Environmental Protection Agency for use in Ghana at scale | | | | | | | | |
|  | |  | | | | | | | | |
| d. Research team | | | | | | | | | | |
| Name | | | Institution | | Role | | | | | |
| Ranajit Bandyopadhyay | | | IITA | | Guidance | | | | | |
| Alejandro Ortega-Beltran | | | IITA | | Management and reporting | | | | | |
| Richard Awuah | | | KNUST | | Guidance | | | | | |
|  | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | |
| Name | | | Institute | Degree | | | | Start | End | |
| 1 Daniel Agbetiameh | | | KNUST | PhD | | | | 2014 | 2018 | |
| 2 | | |  |  | | | |  |  | |
| 3 | | |  |  | | | |  |  | |
|  | | |  | | | | | | | |
| f. Location(s) | | | Northern Region | | | | | | | |
| g. Start | | | August 2017 | | | | | | | |
| h. End | | | September 2018 | | | | | | | |
|  | | |  | | | | | | | |
| 1. Justification | | | | | | | | | | |
| Use of aflasafe is a proven technology to both displace aflatoxin producers in the field and reduce crop aflatoxin content. Aflatoxin contamination is thus reduced before, during, and after harvest, until consumption. In order to have aflasafe GH01 and aflasafe GH02 registered with Ghana’s EPA, it is necessary to finalize the field efficacy trials conducted in 2016. It is expected to finalize analyses by September-October 2017. In addition, in order to optimize the aflasafe technology, it is necessary to determine the frequency of application, persistence of atoxigenic aflasafe strains in treated soils, and the carry-over of atoxigenic strains from one season to the next. During 2017, the third and final year of the carry-over study will be conducted. This investigation has been conducted in the past two years and needs to be finalized in the 2017 cropping season.  In order to have aflasafe products available for use at scale throughout Ghana, both aflasafe GH01 and aflasafe GH02 need to be registered with the Environmental Protection Agency (EPA) of Ghana. Data from efficacy trials conducted during 2015 and 2016 in both maize and groundnut fields will be summarized, analyzed and used to prepare a registration dossier for each product. By the end of 2017, the dossier will be submitted to EPA. Once achieving registration, a commercialization strategy for both products will be designed by IITA’s aflasafe Technology Transfer and Commercialization Project.  The activities under this protocol are related to Activity RT5-Gh-3 in the 2015-16 research year work plan. | | | | | | | | | | |
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| 2. Objectives | | | | | | | | | | |
| 2.1 To finalize analyses of field efficacy trials for preparation of dossier for registration of two aflasafe products for use in Ghana, in both maize and groundnut | | | | | | | | | | |
| 2.2 To develop guidelines indicating mode and frequency of application of aflasafe products in each region and cropping system | | | | | | | | | | |
| 2.3 To prepare a dossier for registration of aflasafe GH01 and aflasafe GH01 with the Environmental Protection Agency of Ghana | | | | | | | | | | |
|  | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | |
| 3.1. Are aflasafe products effective in both displacing aflatoxin-producers in treated fields and decreasing crop aflatoxin content? | | | | | | | | | | |
| 3.2 How often do farmers need to treat their fields with aflasafe to achieve aflatoxin-safe crop? Do atoxigenic strains composing aflasafe displace toxigenic fungi in treated fields and limit aflatoxin contamination? | | | | | | | | | | |
|  | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | |
| **Sub-activity GH111B-1701: Finalize efficacy trials of aflasafe products used in maize and groundnut and continuation of aflasafe carry-over efficacy trials - Leader: Alejandro Ortega-Beltran** | | | | | | | | | | |
| Chemical (toxin) analyses of samples from the field efficacy trials have been completed during the last portion of the year 2016. Microbial analyses of fungal communities associated with treated an un-treated crops is on-going and results will be ready by July-August 2017. Then, data will be summarized, analyzed and used to prepare the dossier for registration of both products with Ghana’s Environmental Protection Agency. Visits will be conducted to both public and private sector organizations willing to include aflasafe into their package of activities to improve the maize and groundnut value chains. Staff of these organizations will be sensitized on the potential benefits of aflasafe and training workshops conducted to train trainers on aflatoxins and its management through use of aflasafe, and who will in turn train farmers under these organizations.  A three year experiment to determine carry-over potential of strains of aflasafe GH01 and aflasafe GH02 is being conducted in the Ghana’s Northern Region. 2017 will be the final trial year and results from this study will allow determining the frequency of application of both aflasafe GH01 and aflasafe GH02. A total of 120 maize fields will be used during the final year. For each aflasafe product, 60 maize (farmers’) fields in a randomized complete block design of six treatments with 10 replications (fields)/ treatment will be used. In treatment 1, fields will be treated in alternate years with aflasafe within the period of the experiment. In treatment 2, fields will be inoculated consecutively in all three growing seasons. Fields in treatment 3 will be inoculated only in the first and second growing season while in treatment 4, field application will be carried out only in the first growing season. Fields in block 5 were not treated in the first two cropping seasons but will be treated only in the third and final year. Fields in block 6 will serve as control with none of the fields inoculated throughout the study period. Field soil samples (100 g) will be collected before application of aflasafe and at harvest to analyze microbial population structure. In addition, crop samples (30 maize ears/field) will be collected at harvest for chemical (aflatoxin) analysis on grains. Conscious efforts will be made to continuing to include youth and female farmers in this trial. | | | | | | | | | | |
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| **Sub-activity GH111B-1702: Registration of two aflasafe products with Ghana-Environmental Protection Agency for use in Ghana at scale - Leader: Alejandro Ortega-Beltran** | | | | | | | | | | |
| Data from field efficacy trials from 2015 and 2016 will be used to prepare the registration dossier following the requirements of Ghana’s EPA regarding registration of biopesticides. Dossiers prepared to register aflasafe products in Nigeria, Kenya, Senegal, and The Gambia will be used as a guide as well. | | | | | | | | | | |
|  | | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | | Responsibility/ Institute | | | |
| 5.1 Baseline data on farmers and coordinates of fields | | | | | | | Daniel Agbetiameh/ IITA | | | |
| 5.2 Data on chemical (aflatoxin) analysis | | | | | | | Daniel Agbetiameh/ IITA | | | |
| 5.3 Data on microbial analysis | | | | | | | Daniel Agbetiameh/ IITA | | | |
|  | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | |
| Deliverables | | | | | | Means of verification | | | | Date |
| 6.1 Microbiological and chemical database: proportion of isolates belonging to the genetic groups to which the atoxigenic strains of aflasafe products belong. Aflatoxin content of treated and non-treated crops. | | | | | | Laboratory testing | | | | Aug. 2017 |
| 6.2 Guideline manual indicating mode and frequency of application of aflasafe products in each region and cropping system. | | | | | | Manual produced by IITA | | | | Jul. 2018 |
| 6.3 Published journal paper "Efficacy of both aflasafe products in reducing aflatoxin accumulation" intended for ‘Plant Disease’ or ‘PLOS ONE’ | | | | | | Acceptance by the Journal | | | | Dec. 2017 |
| 6.4 Dossier for registration of aflasafe GH01 and aflasafe GH02 | | | | | | Approved registration | | | | Dec. 2017 |
|  | | | | | | | | | | |
| 7. Sustainable intensification indicators | | | | | | | | | | |
| 7.1 Productivity | Crop yield at field and farm levels | | | | | | | | | |
| 7.2 Environmental | Biopesticide use at plot level | | | | | | | | | |
| 7.3 Economic | Profitability and input use efficiency and the plot and farm levels | | | | | | | | | |
| 7.4 Social | Gender equity at the farm and household levels | | | | | | | | | |
| 7.5 Human | Production of nutritious foods at the farm and household levels | | | | | | | | | |

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| 8. How will scaling be achieved? |  | |
| Once registered, both products will be available to maize and groundnut farmers across Ghana. IITA is in the process of identifying key partners for production, commercialization, and use of both aflasafe products throughout Ghana at scale as part of the Aflasafe Technology Transfer and Commercialization Project, funded by USAID and the Bill & Melinda Gates Foundation. Scaling up the use of aflasafe will be done in collaboration with the government of Ghana, non-governmental organizations (NGOs), and private sector actors interested in improving maize and groundnut value chains as well as enhance nutritional status of farm households. Producers (farmers) will be linked with premium markets and processors seeking aflatoxin-safe maize and groundnut. | | |
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| 9. How are the activities in this protocol linked to those of others? | |  |
| Linked to protocol GH111A-17 Aflatoxin-safe maize/groundnut from treated fields can be used in studies involving the poultry/livestock feeding trials as well as for studies on household nutrition for children under 5 years. | | |

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| 10. Budget (USD) | |
| Budget Line |  |
| Personnel | 12,000 |
| Services | 7,000 |
| Supplies | 7,000 |
| Capital |  |
| Travel | 4,000 |
| Overhead | 0 |
| Total | 30,000 |

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| **2017 Africa RISING West Africa Activity Protocol – Outcome 1: GH121-17** | | | | | | | | | | |
| *Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, and profitable and sustainably intensified crop-livestock systems linked to markets.* | | | | | | | | | | |
| a. Output: 1.2 | Integrated management technologies and practices to improve and sustain productivity and ecosystems services of the soil, land, water and vegetation resources are developed and disseminated with farmers and development partners in the intervention communities | | | | | | | | | |
| b. Activity: 1.2.1 | Test and disseminate land, soil and integrated land-soil technologies and practices to improve and sustain productivity and ecosystems services at the farm and landscape/watershed levels | | | | | | | | | |
| c. Sub-activity: GH121-17 | Roll out soil and water conservation measures in selected farming systems to demonstrate their role towards in-situ moisture capture and storage, erosion reduction and climate risk adaptation | | | | | | | | | |
| d. Research team | | | | | | | | | | |
| Name | | Institution | | | Role | | | | | |
| Fred Kizito | | CIAT | | | PI: Land management strategies | | | | | |
| Wilson Agyare | | KNUST | | | Co-PI: Soil-water dynamics | | | | | |
| Gundula Fischer | | IITA | | | Gender mainstreaming | | | | | |
| Bekele Kotu | | IITA | | | Economic studies | | | | | |
| Olufunke Cofie | | IWMI | | | Co-PI: Water management | | | | | |
| Richard Appoh | | IWMI | | | Water management | | | | | |
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| e. Student(s) | | | | | | | | | | |
| Name | | Institute | | | | Degree | Start | | | End |
| 1. | |  | | | |  |  | | |  |
| 2. | |  | | | |  |  | | |  |
| 3. | |  | | | |  |  | | |  |
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| f. Location(s) | | Upper East (Bonia and Nyangua) and Northern (Tibali) regions | | | | | | | | |
| g. Start | | May 2017 | | | | | | | | |
| h. End | | February 2018 | | | | | | | | |
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| 1. Justification | | | | | | | | | | |
| During Phase 1, land use changes within agricultural landscapes were evaluated. This revealed that there has been substantial transition of the farming systems and land use patterns, predominantly from shrubland and forested areas into crop land which has taken place alongside other drivers such as low and erratic rainfall and poor soil and land management practices. In order to provide viable interventions and recommendations, we proposed piloting of on-farm trials to address erosion prevalence and land degradation that will in turn increase crop productivity. Soil and land management strategies for improved crop production form an intrinsic component of farming systems. However, these do not act in isolation, there is a need for integrated technologies for crop management that are labor-friendly. The proposed work aims to refine soil and water conservation technologies identified in Phase 1 and disseminate appropriate soil and land management strategies that are labor-friendly but also intensify cereal-legume and livestock farming systems in northern Ghana in conjunction with the crop and crop-livestock activities. The envisaged activities include: 1) Demonstration and implementation of best-bet soil and land conservation interventions for improved crop and water productivity with specific reference to tied ridges, and contour farming practices accompanied with dual-purpose cover crops such as cowpea and soybeans within maize systems; 2) Roll out the economics of soil/land restoration and management strategies for improved crop productivity; 3) In conjunction with the on-farm agronomic trials, train farmers and support their networks on soil and land conservation interventions. Water availability, soil quality and land suitability are intricately linked and are the foundations for food production. However, all these resources are under increasing pressure in northern Ghana as food and living standard demands increase with the rising population pressure. Among others, some of the entry points to managing these pressures while increasing production and buffering against shocks include judicious and economically feasible soil and land management strategies that address the chronic problems associated with soil erosion and subsequent nutrient losses. The proposed work will conduct activities that reduce soil and nutrient losses from the farm systems through soil erosion reduction interventions that subsequently increase root zone soil moisture storage and nutrient availability. Periodic measurement and monitoring of on-farm fluxes will continue in order to provide metrics that help evaluate the performance of the implemented interventions and provide a matrix against which econometric assessments will be conducted. This will be coupled with training and building the capacity of farmers to make decisions with the consideration of the value of soil and land management actions towards in-situ moisture capture and storage, erosion reduction and climate risk adaptation.  The activities are related to those under Activity RT4-Gh-3 in the 2016 research year work plans of Phase 1. | | | | | | | | | | |
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| 2. Objectives | | | | | | | | | | |
| 2.1 Roll out and scale out integrated soil/land and water management practices to increase ecosystems services at the farm and landscape levels. The intervention practices will entail tied ridges, contour farming and contour ridges accompanied with dual-purpose cover crops such as cowpeas or soybeans within maize systems | | | | | | | | | | |
| 2.2 Adapt and disseminate cost-effective, labor-saving, and gender-sensitivity of the soil and land management technologies identified in 2.1 above | | | | | | | | | | |
| 2.3 Develop both human and institutional capacity of target farmers towards in-situ moisture capture and storage, erosion reduction and climate risk adaptation | | | | | | | | | | |
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| 3. Research questions | | | | | | | | | | |
| 3.1 How can we best roll out and disseminate land and soil management practices to improve crop and livestock production and ecosystems services (including soil, water and nutrient cycling) at the farm and landscape/watershed levels? | | | | | | | | | | |
| 3.2. What are the economics associated with soil and land management technologies and are these cost-effective, labor-saving, and gender-sensitive enough to allow for uptake and scaling out these best bet options? | | | | | | | | | | |
| 3.3 How can we develop both human and institutional capacity of target farmers towards in-situ moisture capture and storage, erosion reduction and climate risk adaptation in order to promote better scaling? | | | | | | | | | | |
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| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | |
| **Sub-activity GH121-1701: Roll out and scale out soil and water conservation measures in selected farming systems to demonstrate their role towards in-situ moisture capture and storage, erosion reduction, nutrient movements and climate risk adaptation - Leader: Fred Kizito** | | | | | | | | | | |
| This will entail establishing soil and water conservation measures specifically, tied ridges, contour ridges and native grass strips as well as a control in farmers’ fields. The study will build on the water balance findings from Phase 1 to conduct a detailed analysis of the spatial and temporal trends of the data collected, an aspect that was not done in Phase 1. The assessment will include evaluation of soil conservation practices (both structural and vegetative) towards environmental integrity (allowing moisture infiltration, reducing erosion and nutrient losses). This will also involve use of GIS analysis and spatial modeling to scale-up and out proven land and soil management interventions that have a high potential for increasing agricultural productivity. | | | | | | | | | | |
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| **Sub-activity GH121-1702: Conduct cost-benefit analysis coupled with farmers’ perceptions on gender and labor demands associated with soil and water conservation measures in farming systems- Leader: Fred Kizito** | | | | | | | | | | |
| This activity builds on results derived from the soil and water conservation intervention strategies and has an economist and a gender expert on the team to provide guidance and insights on both economic and gender issues. Where situations are better-suited to segregation of genders for group work, we will address these as they arise and also on local advice and customs. In collaboration with other work packages, gender issues will be addressed through creation of gender awareness and gender equity in all the project stakeholder meetings. Barriers-to-participation are reduced by offering gender sensitive interventions and the use of appropriate styles and language in all capacity building activities. This work package will strive to ensure inclusion of women groups in the project activities in order to impart skills and knowledge to women. Specifically, we shall:   * Conduct economics of farm productivity that incorporate labor and level of effort for land and soil conservation measures; * Quantify losses associated for the lack of action (would use on-farm counter-factual results); quantify (monetary and non-monetary) the benefits of action associated with interventions through a cost-benefit analysis and willingness to invest in soil and water conservation strategies   This will entail working closely with communities through practical in-field excursions with hands-on construction of soil and land management conservation structures while incorporating existing indigenous knowledge and other knowledge gathered from previous efforts and NGO exposure. (It is envisaged that this activity will come earlier in the process and will involve close collaboration with other work-packages for co-planning of events). It will also involve reinforcing knowledge during and after the cropping season.  This will also entail developing brochures and training manuals for educating and training farmers and extension officers in soil and water conservation measures. | | | | | | | | | | |
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| 5. Data to be collected and uploaded | | | | | | | | Responsibility/Institute | | |
| 5.1 Roll out and scale out soil and water conservation measure:  Measurements and metrics:   * Soil losses will be monitored by a modified version of a calibrated runoff soil loss detectors that captures 75% of the plot runoff zone; * Climatic variables: Rainfall, air temperature, wind speed and relative humidity for crop evapotranspiration measurements; * Nutrient dynamics will be monitored using suction lysimeters which will be held at a tension of 70 cbars and installed at varying depths along the profiles of interest in order to ascertain fate and transport as well as verify what percentage is captured within the crop root zone; * Soil moisture will provide vital links to both soil and nutrient losses. Soil moisture will be monitored using a diviner probe (Sentenk Inc.) to depths of 1.6 m at 10 cm increments within the profile. Access tubes for moisture measurement with the diviner probe will be installed in the center position of the target plots; * Infiltration rates with a portable mini-disk infiltrometer | | | | | | | | CIAT/KNUST | | |
| 5.2 Conduct cost-benefit analysis coupled with farmers’ perceptions on gender and labor demands:  Metrics and data: Cost of inputs, amount of gender disaggregated labor demanded throughout the cropping season for soil and water interventions, yield levels, total income from a plot or farm level, off-season labor demands for reinforcing of soil and water conservation structures | | | | | | | | CIAT/KNUST | | |
| 5.3 Develop both human and institutional capacity of target farmers towards improved soil and water conservation measures:  We shall assess the knowledge, attitude, skills and aspirations of farmers before and after the trainings and capacity building exercises. We shall use the KASA framework to make these assessments | | | | | | | | CIAT/KNUST | | |
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| 6. Milestones | | | | | | | | | | |
| Deliverables | | | | Means of verification | | | | | Date | |
| 6.1 Soil-crop-forage interactions rolled out and assessed at 3 project sites: Upper East (Bonia and Nyangua) and Northern Region (Tibali);  areas with high potential identified and mapped | | | | Research report and partner work plans (CIAT/KNUST) | | | | | Jul. 2017 | |
| 6.2. Economics of farm productivity conducted with partial budgets and cost-benefit analysis that includes a gender lens | | | | Research report and journal publication | | | | | Nov. 2017 | |
| 6.3. Training manuals and brochures rolled out on soil and water conservation measures | | | | Research report including list of participants and training agenda | | | | | Nov. 2017 | |
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| 7. Sustainable intensification indicators | | | | | | | | | | |
| 7.1 Productivity | | | Crop yield and planting density at the plot levels. | | | | | | | |
| 7.2 Environmental | | | Erosion, soil health-quality, nutrient partial balances, runoff and water productivity at the plot levels | | | | | | | |
| 7.3 Economic | | | Profitability and Input Use Efficiency at plot and farm level | | | | | | | |
| 7.4 Social | | | Gender equity and collective action in labor and other resource uses | | | | | | | |
| 7.5 Human | | | Capacity to experiment | | | | | | | |
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| 8. How will scaling be achieved? | | | | | | | | | | |

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| Strategic partnerships with both public and private sector entities for public sector: we shall liaise with MoFA, theprivate sector, SNV and local universities. We envisaged that the targeted partners will be contacted and will be on board in August/September 2017. We shall involve the use of GIS analysis and spatial modeling to scale-up and out proven land and soil management interventions that have a high potential for increasing agricultural productivity while including crop suitability potential. This scaling mechanism will be developed and rolled out for the target sites by December 2017. The use of participatory video methods and maps will be used as information sharing methods in the target sites with partners and will complement the scaling-up and out through farmer to farmer exchanges on soil and land management interventions that increase on-farm productivity. We link up with on-going initiatives and partnerships such as Northern Agricultural Sector Working Group (NASWG) and NRGDP as scaling pathways for our research. This will include sharing with them brochures developed for farmer training as well as co-sharing in-field experiences at working group discussions including MoFA as well. |
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| 9. How are the activities in this protocol linked to those of others? |
| Linked to protocols GH111A-17 and GH122-17. This is an integrative activity in that CIAT, IITA, IWMI and KNUST will collaborate on soil and water conservation incorporation within farming systems. The work also closely links with IITA on cereal-legume cropping systems and will mimic the soil and water conservation approaches that incorporate grass strips in farming systems that have been successfully implemented in East Africa and will bring cross-regional insights. Insights from our work will be shared with IWMI for cross-learning opportunities between soil/land management strategies and water management interventions within the target farming systems. |

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| 10. Budget (USD) | | |
| Budget Line | CIAT | KNUST |
| Personnel | 25,300 | 4,000 |
| Services | 2,700 | 1,150 |
| Supplies | 3,600 | 1,200 |
| Capital | 900 | 700 |
| Travel | 3,600 | 1,500 |
| Overhead | 3,900 | 1,450 |
| Total | 40,000 | 10,0001 |
| 1Funds allocated by CIAT to KNUST | | |

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| **2017 Africa RISING West Africa Activity Protocol – Outcome 1: GH122-17** | | | | | | | | | | |
| *Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, and profitable and sustainably intensified crop-livestock systems linked to markets.* | | | | | | | | | | |
| a. Output: 1.2 | | Integrated management technologies and practices to improve and sustain productivity and ecosystems services of the soil, land, water and vegetation resources are developed and disseminated with farmers and development partners in the intervention communities | | | | | | | | |
| b. Activity: 1.2.2 | | Test and promote water management technologies and practices to increase water productivity in the small-scale crop-livestock farming systems under rain fed and irrigated conditions | | | | | | | | |
| c. Sub-activity: GH122-17 | | Research after agricultural water management under rain fed and irrigation conditions to improve water productivity in integrated crop-livestock systems of northern Ghana | | | | | | | | |
| d. Research team | | | | | | | | | | |
| Name | Institution | | | | Role | | | | | |
| Zenebe Adimassu | IWMI | | | | Agricultural water management | | | | | |
| Marloes Mul | IWMI | | | | Hydrology and water resources | | | | | |
| Richard Appoh | IWMI | | | | Establishment of trails and data collection | | | | | |
| Jean-Baptiste Tignegre | WorldVeg | | | | Vegetable breeding | | | | | |
| Fred Kizito | CIAT | | | | Land and soil management | | | | | |
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| e. Student(s) | | | | | | | | | | |
| Name | Institute | | | | Degree | | | Start | End | |
|  |  | | | |
| f. Location(s) | Upper East Region | | | | | | | | | |
| g. Start | Apr. 2017 | | | | | | | | | |
| h. End | Mar. 2018 | | | | | | | | | |
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| 1. Justification: | | | | | | | | | | |
| Agriculture contributes about 25 % to Ghana’s GDP while employing over 56 % of the labor force serving as the major source of livelihood for many rural communities in Ghana. In northern part of the country, rain-fed agriculture is predominant, with a uni-modal rainy season from May to September and intra-seasonal droughts. Water is therefore a key limiting factor for production in spite of the average annual rainfall amounts exceeding 1,000 mm/yr. Results from the Africa RISING (AR) Phase 1 research in northern Ghana show that there is a 60-80% chance of having more than seven consecutive days of dryness and 30-40% chance of more than 10 days dryness in the rainy season (Adimassu et al, forthcoming). Along period of dryness at sensitive times of plant development (germination, flowering, seeding) during the rainy season can be disastrous for smallholder farmers (Barron et al, 2003[[3]](#footnote-3); Mul et al., 2016[[4]](#footnote-4)), adding to their vulnerability to climate variability. While shorter dry spells of 7-10 days can be overcome by infield water harvesting and by increasing water holding capacity of the soils, longer dry spells (14-21 days) require supplementary irrigation. Our results showed that northern Ghana record up to 25% reduction in maize yield due to long dry spells (Adimassu et al., forthcoming). Available evidence also shows that current maize yield in northern Ghana could increase to 4-6 tha-1 through reduced crop water deficit during rainy season, which is around 50 to 70% of potential achievable yields (see e.g. Global Yield Gap and Water Productivity Atlas[[5]](#footnote-5)). Effective water management reduces risk in crop and livestock systems, building resilience towards shocks and change, and enhancing value of other farm inputs such as improved seeds, labor fertilizer/ nutrients and e.g., integrated pest and weed management in crop–livestock production systems.  Beyond the uni-modal rainy season, long period of dry season in northern Ghana offers opportunity for farmers to intensify and diversify their production systems. Currently, only a small proportion of the cropland in northern Ghana is under more than one crop cycle per year whereas surface and groundwater resources are abundant on annual basis to realize double or triple cropping. For example, in the Anyari transboundary watershed which has an area of 253 km2 within Ghana and which has some of the Africa RISING vegetable hubs, our research (Ofosu-Antwi et al., 2017[[6]](#footnote-6)) shows that harvesting just 10% of the surface runoff by using dams, dugouts and underground tanks can support an irrigable area of 1,750 ha which could be used for dry season agriculture. In addition to surface water, the groundwater resources can irrigate up to 4,500 ha of land sustainably without any water stress. Upscaling irrigation in the Anyari catchment to 6,250 ha would lead to only 0.01% reduction in stream flow to Akosombo dam downstream of the Volta. When the untapped resources are explored, together with other considerations such as access to inputs, credit, market, and good agronomic practices, dry season production system that responds to local and regional price fluctuations in major commodity crops could provide additional source of income for farming households (Katik et al., 2017[[7]](#footnote-7)).  Although water management solutions offer greater security to agricultural production (ICSU, ISSC, 2015[[8]](#footnote-8)) and expand the options for sustaining livelihoods as well as ensuring food security and nutrition (Domenech, 2015[[9]](#footnote-9)), the efficiency of water in agricultural production is low at farm level. Generally, only the crop effectively uses 40 to 60% of applied water, the rest is usually lost through various processes including evaporation, runoff, and percolation into the groundwater. It is therefore critical to develop agricultural water management strategies with smallholder farmers to attain better productivity and efficiency of water for sustainable intensification, and contribution to Sustainable Development Goals (SDG), especially SDG 6.3 for water productivity improvements  A first step is to ensure intra seasonal dry spells is managed during rain fed seasons. Furthermore, it is important to ensure that the right amount of water is applied at the right time to avoid needless waste of water and energy. Unfortunately, many small-scale farmers do not have the knowledge and tools for determining the right amount of water and time to apply. Irrigation scheduling ensures that water is optimally available to the plant if applied according to crop requirements. However, irrigation also incurs a cost for labor and energy so the optimal water allocation from the biophysical and crop production perspective should coincide with the economic optimal water productivity. Simple decision support tools can be used to guide farmers on when to irrigate and in what amount. For example, WRI and partners recently introduced an ICT-based tool for irrigation advisory service to the irrigation sector in Ghana. Preliminary results show that it is possible to incorporate near-real time monitoring of climate and soil conditions with spreadsheet based water balance models to advice farmers regarding when to irrigate and how much water to apply. Such tools can be used by irrigation officers, agronomist, agricultural extension agents and some farmers, with minimal training. Although it has been applied to some elected formal irrigation schemes in Ghana, its adaptability to smallholder single farm units is yet to be proven. In addition, IWMI introduced the wetting front detectors (WFD) during the phase 1 of AR in Ethiopia and in Ghana. While in Ethiopia, the use of WFD in guiding supplementary irrigation of oats and vetch resulted in 64% yield increase, the investigation in Ghana has so far been constrained by multiple factors.  Research is needed to understand to what extent the access to scheduling tools such as the WFD and ICT-based tools would improve crop and water productivity. Furthermore, the interaction of water deficit and soil amendments to improve vegetable (tomato) production has received little attention. Water deficit and soil nutrient management have been studied in isolation and the synergy has not been explored. It is hypothesized that the interaction of soil water deficit and soil nutrient management will provide new technology to improve tomato yields in the Upper East Region. This will provide new options to for tomato production in soil nutrient stress and water deficit environment in the Upper East Region. We therefore propose our research to focus on improving agricultural water management in sustainable intensification of northern Ghana smallholder rain fed and dry season crop-livestock production systems.  The proposed activities are related to activities RT4-Gh-1 and RT4-Gh-2 in the 2016 research year work plans of Phase 1. | | | | | | | | | | |
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| 2. Objectives: | | | | | | | | | | |
| 2.1 Assess the incidence of dry spell occurrence and its impacts on AR commodities, in crop-livestock systems and provide recommendations for mitigation measures | | | | | | | | | | |
| 2.2 Assess the effectiveness of a computerized water balance irrigation scheduling tool for enhancing irrigation efficiency and crop productivity in dry season vegetable production systems | | | | | | | | | | |
| 2.3 Assess the effectiveness of the Wetting Front Detector (WFD) irrigation scheduling tool for dry season vegetable production system and the implication on crop water productivity | | | | | | | | | | |
| 2.4.1 To assess soil water and organic amendments effects on tomato crop production in the Upper East Region of Ghana | | | | | | | | | | |
| 2.4.2 To assess soil N mineralization under soil water and organic amendments management in tomato production | | | | | | | | | | |
| 2.4.3 To study soil N leaching under soil water and organic amendments management in tomato production | | | | | | | | | | |
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| 3. Research questions | | | | | | | | | | |
| 3.1 What is the extent and impacts of dry spell occurrence in the production of major AR commodities, in crop-livestock rain fed production systems? What are the appropriate measures to mitigate DS and improve productivity? | | | | | | | | | | |
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| 3.3 How effective and applicable is the WFD for scheduling irrigation of different dry season vegetable production? | | | | | | | | | | |
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| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | |
| **Sub-activity GH122-1701: Analysis of dry spell incidence in cereal-legume cropping systems - Leader: Zenebe Adimassu** | | | | | | | | | | |
| A dry day is taken to be a day with less than 0.85 mm of rainfall while a dry spell is a period with consecutive dry days once the cropping season begins. Dry spells are categorized into different length and occurrences in different crop stages. Dry spell analyses in Africa RISING phase 1 had focused on 90-day maize crop for nine rain gauge sites in northern Ghana and for six crops using the Navrongo rainfall data (Adimassu et al., 2017[[10]](#footnote-10) ). This study will expand the analysis to integrate yield response towards dry spells. Historical rainfall data from meteorological stations in northern Ghana with daily rainfall data covering at least twenty years will be analyzed for dry spells. Long-term dry spell analysis would be carried out using INSTAT+ v3.37. The probabilities of dry spell lengths exceeding 7, 10, 14 and 21 days will be calculated. The probabilities will be calculated to cover each growing stage for major crops grown in the Africa RISING project. CROPWAT 8.0 model (FAO, 2005[[11]](#footnote-11)) will be used to estimate yield responses using historical data, and compared to the dry spell categories. | | | | | | | | | | |
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| **Sub-activity GH122-1702: Determining appropriate water scheduling methods for enhanced crop and water productivity in dry season vegetable production – - Leader: Richard Appoh** | | | | | | | | | | |
| Irrigation scheduling technologies will be tested in the vegetable hubs located in Nayngua and Tekuru in collaboration with World Vegetable Centre to assess the impact on crop water productivity as well as the socio-economics requirements for up scaling.  Water scheduling: Wetting Front Detector, a sensor-based simple tool will be tested on vegetables to be selected by farmers. This will assist them to schedule the irrigation of vegetables. The tool indicates when the root-zone is dry and when it becomes saturated during irrigation. The water productivity using the sensors will be compared against i) a fixed irrigation schedule and ii) the farmers’ normal practice. Recommended fertilizer and pest management practices will be implemented for all treatments. The experiment will provide an opportunity for farmers to compare the tested irrigation scheduling methods (Wetting Front Detector, crop water requirements and farmer practice) with respect to income, water, labor and time savings. | | | | | | | | | | |
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| 5. Data to be collected and uploaded | | | | | | Responsibility/Institute | | | | |
| 5.1. For dry spell analysis: climate data including rainfall data, temperature, PET (20-30 years) | | | | | | IWMI | | | | |
| 5. 2 For dry season vegetable production:   * Yield – [marketable yield (kg/plot), unmarketable yield (kg/plot), total yield (Kg/ha)] at each harvest. * Soil moisture * Irrigation quantity applied and frequency * Fertilizer (type, quantity, timing, cost) * Weed control (type, quantity, timing, cost) * pest control (type, quantity, timing, cost) * What, when and how much labour involved * Cost of other inputs * Total income from the plot (Cedis/farm) | | | | | | IWMI | | | | |
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| 6. Milestones | | | | | | | | | | |
| Deliverables | | | Means of verification | | | | | | | Date |
| 6.1. Dry spell incidence mapped out for AR regions in Ghana | | | A journal paper submitted to Agric. Water Management | | | | | | | Dec. 2017 |
| 6.3. Recommendations on irrigation scheduling methods for enhanced crop water productivity in the dry season | | | A project report to be published on CGspace on effects of irrigation scheduling on crop and water productivity | | | | | | | Mar. 2020 |
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| 7. Sustainable intensification indicators | | | | | | | | | | |
| 7.1 Productivity | | | | Crop production at plot and field levels. | | | | | | |
| 7.2 Environmental | | | | Water availability: Field/plot level/metrics | | | | | | |
| 7.3 Economic | | | | Profitability and input use efficiency at the field level | | | | | | |
| 7.4 Social | | | | Gender equity; collective action in the use of available water resources | | | | | | |
| 7.5 Human | | | | Food Security: Field/plot level/metrics Food production (Participatory assessment, survey) | | | | | | |
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| 8. How will scaling be achieved? |  | |
| Scaling will be achieved by organizing stakeholder meetings with farmers and extension officers on the results of the trials, the preferred water scheduling and application methods during the dry season as well as the supplementary irrigation options for rainy season production. The project teams will share research results and engage with potential scaling partners in the Northern Agricultural Sector working Group (NASWG) which is a dialogue platform for engaging the government and development partners in the realization of the agriculture policy in the north. Co-generation of knowledge through on-farm demonstration will be used to scale out innovative technologies. Fact sheets, workshops, radio discussions, policy briefs, as well as scientific papers publication will be used to communicate to the wider populace. | | |
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| 9. How are the activities in this protocol linked to those of others? | |  |
| Linked to GH111A-17 and GH122-17. | | |

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| 10. Budget (USD) | | | | | | |
| Budget Line | IWMI | | | | | |
| Personnel | 35,300 | | | | | |
| Consultant | 1,000 | | | | | |
| Services | 12,910 | | | | | |
| Supplies | 952 | | | | | |
| Capital |  | | | | | |
| Travel | 9,000 | | | | | |
| Overhead | 10,838 | | | | | |
| Total | 70,000 | | | | | |
| **2017 Africa RISING West Africa Activity Protocol – Outcome 2: GH211-17** | | | | | | | | | | | | | |
| *Outcome 2: More farmers and farm families in the intervention communities are adopting technologies and practices to improve nutrition, food and feed safety, post-harvest handling and value addition.* | | | | | | | | | | | | | |
| a. Output: 2.1 | | | Improved technologies, practices and habits to increase production and consumption of diverse and more nutritious food by farm families, especially by women and children, are developed | | | | | | | | | | |
| b. Activity: 2.1.1, 2.1.2, 2.1.3 | | | Develop a nutrition strategy to harmonize the nutrition activities with the national nutrition approaches and link them to the crop and livestock activities; train farm families to produce and consume diverse and nutritious food; and use nutrition activities for greater involvement of younger women and youth | | | | | | | | | | |
| c. Sub-activity: GH211-17 | | | Evaluation of nutrition-sensitive-agriculture options in West Africa | | | | | | | | | | |
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| d. Research team | | | | | | | | | | | | | |
| Name | | Institution | | | | | | | Role | | | | |
| Augustine Ayantunde | | ILRI | | | | | | | Lead livestock component | | | | |
| Mahama Saaka | | UDS | | | | | | | Lead nutrition component | | | | |
| Jean Baptiste Tignegre | | WorldVeg | | | | | | | Vegetable production | | | | |
| Adda Waseh | | UDS | | | | | | | Ruminant nutrition | | | | |
| Emmanuel Adu | | ARI | | | | | | | Animal production | | | | |
| WIAD Officer | | MoFA | | | | | | | Agricultural extension | | | | |
| Herbert Dei | | UDS | | | | | | | Poultry nutritionist | | | | |
| District Nutriton Officers | | GHS | | | | | | | Nutrition education | | | | |
|  | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | |
| Name | | | | | Institute | | | Degree | | | Start | | End |
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| f. Location(s) | | | | | Selected intervention communities in the three regions | | | | | | | | |
| g. Start | | | | | 2017 | | | | | | | | |
| h. End | | | | | 2021 | | | | | | | | |
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| 1. Justification | | | | | | | | | | | | | |
| The USAID commissioned external evaluation team in Phase 1 stated that: *'... generally, nutrition programming is sporadic and poorly integrated with other programming efforts, therefore requiring a more deliberate programming in relation to agronomy and livestock' and ‘Africa RISING in West Africa appears to work primarily with an older demographic, with limited visibility of younger women or men in trials'*. They recommended that: 1) the nutrition activities should be harmonized with national nutrition approaches, and provide opportunities for capacity building and active participation of government nutrition workers; 2) the nutrition focused activities should be used as an entry point for greater levels of involvement of younger women, since the program's current work involves only older women; 3) younger women and youth should be more proactively targeted to participate in the program; and 4) more deliberate emphasis should be placed on supporting women's specific areas of interest (e.g., small ruminants, poultry and dry season vegetable production). This activity protocol addresses the above recommendations of the external evaluation team by linking the nutrition with the livestock and vegetable production activities focusing on women and children under 5 years as well as the youth.  Agricultural practices and interventions can be better adapted and redesigned to maximize health and nutrition benefits and to reduce malnutrition and diseases. In northern Ghana, where small-scale livestock rearing is practiced in nearly 80% of the households, the prevalence of under-nutrition and micronutrient deficiencies remains unacceptably high. In rural areas of northern Ghana, inadequate intake of micronutrients is widespread primarily because staple diets are predominantly cereal based, and intake of animal source foods are low. More efforts to raise small animals and promote consumption of their products will enhance dietary quality and ensure optimal growth, health and cognitive development in young children. Promotion of dietary diversity using locally available nutritious foods is an effective approach in low-income areas to improve the quality of young children's diets and, hence, their growth and development. The proportion of growth stunted children is highest (33.1 %) in northern Ghana compared to other regions in the country. Similarly, 82 % of children aged 6-59 months have some level of anemia (Hb<11g/dL). Dietary quality and diversity remain unsatisfactory in many households (GSS et al., 2015[[12]](#footnote-12)).  The importance of consumption of animal source food (ASF) for cognitive development of children is well documented. For example, nutritional study in Gourma in Northern part of Mali showed that the children of mobile pastoralists were better nourished based on weight-height, weight-age and height-age measures than children of sedentary farmers and that the children of the sedentarized pastoralists seem to be worst off (Pedersen and Benjaminsen, 2008[[13]](#footnote-13)). The children under these studies were 6 to 60 months. The explanation for this trend was largely attributed to the consumption of milk. This underscores the important role that livestock systems play in human nutrition as the households that keep livestock are more likely than their non-holding counterparts to consume ASF because of their proximity to the nutrient-rich foods. Increased consumption of ASF by the rural households may prevent or reduce stunting in children and will improve the health of the households particularly children and vulnerable women. Thus, there is need for increased consumption of animal source food by the households in crop-livestock systems in Africa RISING intervention communities where staple food is largely based on cereals.  One pathway to improve the consumption of ASF is through improvement in livestock production, for example improved milk and meat by ruminants (cattle, sheep and goats) and non-ruminants (poultry and pigs), and egg production by poultry. As the women are key in the household nutrition, livestock-related nutrition interventions should be gender-sensitive. Bringing together agriculture, nutrition and health will help to address immediate and underlying causes of malnutrition and nutrition insecurity in the Africa RISING intervention communities. In addition to interventions to improve household nutrition, there will be focus on building capacity in best nutrition practices and nutrition behavior change communication targeted at women to foster the creation of an environment where women feel comfortable to change and adopt best nutrition practices.  It is widely known that nutritional status during foetal life influences the postnatal growth and body composition of children but little information is available on how consumption of animal source foods (ASF) affects foetal and postnatal growth as a continuum. Besides, no randomized controlled intervention trials have investigated the effects of prenatal food-based interventions on the outcomes of the offspring, including postnatal growth within the context of women empowerment in agriculture production of ASF. Therefore, this study serves as an opportunity to collect follow-up data of the women and their offspring at birth and through the first three years postpartum. The intervention trial proposes to answer whether production of ASF reduces micronutrient deficiencies and promotes foetal and postnatal growth. In this study, the effects of the improved intensification options with and without nutrition education on maternal and child nutritional status, child care practices, income, and workload will be investigated.  In addition to ASF, consumption of other nutritious food and vegetables is necessary and will be addressed in this study. For poor households, vegetables and fruits are often the only source of micronutrients in the family diet. Homestead production of fruits and vegetables such as okra, Amaranth and vegetable cowpea provides the household with direct access to important nutrients that may not be readily available or within their economic reach. This underscores the importance of the home garden for household nutrition. Therefore, home gardening will be a good means to improve household food security and diet. The household garden is a small-scale production system supplying plant and animal consumption and utilitarian items either not obtainable, affordable, or readily available through retail markets, field cultivation, hunting, gathering, fishing, and wage earning.  The nutrition activities proposed in this study are designed to target women and children. Women play a critical role in household nutrition as the primary producers of micronutrient rich vegetables, and they are responsible for the purchase of food at the local markets and preparation of food in the home. In addition, they take care of the children under 5 years old. Consequently, the integrated package for improving household nutrition through this study will be given to women in the selected Africa RISING intervention communities.  This protocol covers activities 2.1.1, 2.1.2 and 2.1.3 in the Africa RISING West Africa Phase 2 log frame (Table 1); and activities, RT2-Gh-3, RT3-Gh-1, RT3-Gh-2, RT3-Gh-3 and RT5-Gh-1 in the 2017 research year work plans. | | | | | | | | | | | | | |
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| 2. Objectives | | | | | | | | | | | | | |
| 2.1 Develop a nutrition strategy for the project | | | | | | | | | | | | | |
| 2.2: To: (i) characterize nutrition practices of the households in the study areas and quantify gender-differentiated roles in household nutrition practices; (ii) assess the effect of livestock productivity enhancing interventions and vegetable production in home-gardens with or without nutrition education on household nutrition particularly children under 2 years and women of reproductive age. The underlying hypothesis is that productivity enhancing intensification options will lead to improvement of household food security and nutrition thereby enhancing gender equity | | | | | | | | | | | | | |
| 2.3: To determine the operational feasibility and effectiveness of women’s empowerment in agriculture to increase production diversity and improve maternal and child nutritional outcomes without compromising child care practices | | | | | | | | | | | | | |
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| 3. Research questions | | | | | | | | | | | | | |
| 3.1: Do improved intensification options with and without nutrition education impact on maternal and child nutritional status and child care practices? | | | | | | | | | | | | | |
| 3.2 Will the nutritional status of children and pregnant women be improved through combined Women’s Empowerment in Agriculture and Social Behavior Change Communication (SBCC) that promote production and consumption of animal-source foods (ASF) such as poultry and small ruminants? | | | | | | | | | | | | | |
| 3.3 Does social mobilization for nutrition and health create a platform for young women to adopt and practices best nutrition practices? | | | | | | | | | | | | | |
| 3.3: Can women’s empowerment in agriculture lead to increased production diversity and dietary diversity without compromising child care practices? | | | | | | | | | | | | | |
| 3.4 Can homestead gardening increase household food security and nutrition in rural household of northern Ghana? | | | | | | | | | | | | | |
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| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | |
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| **4.1Linking nutrition and crop-livestock research and development activities- Leader(s): Asamoah Larbi and Mahama Saaka** | | | | | | | | | | | | | |
| In response to the recommendations of the USAID commissioned evaluation team, a consultant will be hired to develop a nutrition strategy for the regional project. The strategy will indicate how the nutrition activities will be linked to the livestock and crop research activities. This activity was planned for 2016. It could not be implemented due to delays in hiring a consultant. | | | | | | | | | | | | | |
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| **4.2 Evaluation of nutrition sensitive agriculture options - Leaders: Augustine Ayantunde and Mahama Saaka** | | | | | | | | | | | | | |
| Community based intervention using a quasi-experimental design with a baseline survey and an end of project survey will be used. The study will be conducted in at least 4 Africa RISING intervention communities and will involve focus group discussions and individual surveys to collect gender-disaggregated data on roles of gender in household nutrition and to characterize household nutrition practices of the selected households. A cluster-randomized controlled intervention trial will be used with an intervention group in selected communities in the Northern region and a non-intervention group in control communities in Upper East region. A survey of marketed foods in the study areas will be conducted as available food types in the markets and price may influence household nutrition and diet diversity. To establish dietary diversity of selected households, surveys will be executed that quantify the Minimum Diet Diversity for Women (MDD-W) score, and infant and young children feeding practices (children dietary diversity score, minimum acceptable diet). In addition, anthropometric measurements (weight for age/height, height for age) of children in selected households in the study areas will be carried out.  Project interventions will include introduction of livestock (e.g., dairy goat, domestic chicken or guinea fowl) breeds to the intervention communities after assessment of performance on-station. The dairy goats and domestic chicken or guinea fowl will be given to selected women in 2 project communities in Northern region to manage after training in improved husbandry practices while 2 other communities in Upper East where there is no intervention will serve as control. The women are targeted to ensure that the milk and egg produced goes into household nutrition, particularly for consumption by children under 2 years. In addition to livestock intervention, a vegetable garden will be established by the women involved in the treatment communities and they will be trained in improved cooking practices for preparing the vegetables grown for household consumption. The manure from goats will be collected and applied to vegetable garden.  The trained women are expected to have gained knowledge about gardening, and animal husbandry thereby getting a better understanding of how agricultural interventions can improve family nutrition and health. This perceived benefit of the interventions is expected to motivate the women to actively participate in the study. Behavior change communication (BCC) group sessions on improved nutrition and cooking demonstrations (aimed at optimizing the nutritional quality) will be held targeting particularly women of reproductive age. Community mobilization activities will be organized in targeted villages with selected groups including local stakeholders, and groups of men and grandmothers. A quasi experimental design will be used to evaluate the impact of this intervention on target communities by using the data collected during the baseline and the end of project survey. Gender disaggregated data will be collected during monitoring activities and surveys.  Information on demographic, socio-economic and home garden information will be collected during household interviews using a structured questionnaire. An inventory of the cultivated plant species will be compiled and the number of individual plants of each species documented. Household food intake will be assessed by a qualitative recall of foods consumed by the household during the 24 hour preceding the survey from the household member who prepared the previous day’s meals. The main independent variable will be production and consumption of nutrient-dense foods. Household food security will be assessed by using food consumption score (FCS) developed by the World Food Programme (WFP).  A quasi-experimental design will be used with an intervention group in selected communities in one region and a non-intervention group in selected communities in an adjacent region. In the first year of the study, an appropriate sample size of pregnant women in the first trimester will be enrolled and they will be selected from 30 clusters. The clusters will be selected using the probability proportionate to size (PPS) method. Pregnant women in the first trimester will constitute the target group for this study because of their vulnerability to malnutrition and intergenerational transfer of malnutrition. The participants will be randomly assigned to one of the following treatment arms:  (i) Usual diet + Social Behavior Change Communication (SBCC).  (ii) Production of ASF (guinea-fowls, sheep, goats, poultry etc.) + vegetables  (iii) SBCC + ASF + vegetables  The main activities will a) include provision of facilities to women’s groups for rearing livestock such as goats and sheep or guinea-fowls, b) provision of improved breeds of animals and guinea-fowls, c) Social behavior Change Communication in project communities, d) training, monitoring of activities, e) conduct a baseline and follow-up studies. | | | | | | | | | | | | | |
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| 5. Data to be collected and uploaded | | | | | | | | | | Responsibility/Institute | | | |
| 5.1: Infant and young child feeding (IYCF) practices to measure minimum dietary diversity (MDD), minimum meal frequency (MMF), and minimum acceptable diet (MAD); Nutritional status of children measured in terms of height-for-age Z-score (HAZ), weight-for-height Z-score (WHZ) and weight-for-age Z-score (WAZ); Body mass index (BMI) and mid upper arm circumference for women; food access information as measured by household food insecurity access scale (HFIAS) and market prices of food, changes in nutritional knowledge of women | | | | | | | | | | UDS/ILRI/ARI | | | |
| 5.2 Survey data upload in CKAN | | | | | | | | | | UDS/ILRI | | | |
| 5.3 Monitoring data upload in CKAN | | | | | | | | | | UDS/ILRI | | | |
| 5.4 Animal performance data | | | | | | | | | | ILRI/ARI | | | |
| 5.5: Access to nutritious foods, Dietary diversity, Food consumption score, Nutritional status (underweight, stunting, wasting), Uptake of essential nutrients, Food availability, Food accessibility, Food utilization, Food security composite index, Months of food insecurity and **household income and expenditure levels** | | | | | | | | | | UDS/WIAD/District Assemblies | | | |
| 5.6 Data on maternal dietary intake, maternal micronutrient status assessment (e.g. iron, zinc), birth size (i.e. birth weight, length), growth rate during the first three years of life, anthropometric indicators during pregnancy (e.g. gestational weight gain). On enrolment, mid upper arm circumference, weights and heights of the pregnant women will be measured. Additionally, age, parity, level of education, employment, and other socioeconomic information will be collected as independent variables | | | | | | | | | | Nutrition and Animal Science Departments of UDS/GHS | | | |
| 5.7 Data on Women’s Empowerment in Agriculture Index [WEAI] and its component indicators will be used to assess the extent of women’s empowerment in agriculture. WEAI is an aggregate indicator composed of two sub-indexes: (1) the five domains of women’s empowerment [5DE] and (2) the Gender Parity Index (GPI) | | | | | | | | | | Nutrition and Animal Science Departments of UDS/MOFA | | | |
| 5.8 Data to be collected on vegetables include plant height at 50% flowering, number of leaves/plant, number of fruits/plot and fruit weight (1st, 2nd and 3rd harvest), quantity consumed. Data will also be collected on farmers’ sex, age, wealth, farm land GPS position, annual rainfall | | | | | | | | | | WorldVeg/IITA | | | |
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| 6. Milestones | | | | | | | | | | | | | |
| Deliverables | | | | | | Means of verification | | | | | | Date | |
| 6.1 Baseline survey data (quantitative and qualitative) | | | | | | Report submitted to Africa RISING and data upload in CKAN | | | | | | Dec. 2017 | |
| 6.2 Progress report on the on-station assessment of the productive performance of improved dairy goat and domestic chicken/guinea fowl, and development of feed package for the dairy goat | | | | | | Reports submitted to Africa RISING | | | | | | Jan. 2018 | |
| 6.3 Progress report on the establishment of home garden (nutrition garden) and monitoring | | | | | | Reports | | | | | | Jan. 2018 | |
| 6.4 Training in best nutrition practices and improved animal husbandry | | | | | | Reports | | | | | | Various dates | |
| 6.5 End of project survey data (quantitative and qualitative) | | | | | | Report submitted and data upload in CKAN | | | | | | May 2020 | |
| 6.6 Articles published in the following areas:   1. Effect of consumption of animal source foods (ASF) on foetal and postnatal growth (August 2018) 2. An evaluation of improved intensification options with and without nutrition education on maternal and child nutritional status, child care practices, income, and workload (August 2019) 3. An assessment of the operational feasibility and effectiveness of women’s empowerment in agriculture to increase production diversity and improved maternal and child nutritional outcomes without compromising child care practices (December 2019) 4. The effect of an integrated livestock-vegetable-nutrition intervention on dietary intake and nutritional status of children under 3-years and pregnant women (December 2018) | | | | | | At least 2 journal articles on nutrition-sensitive agricultural interventions available online | | | | | | 2018, 2019 | |
| Articles pending from Phase 1:   1. Evaluation on the effect of nutrition education package to improve household nutrition in Northern Ghana (May, 2017) 2. The combined effects of the provision of feed and healthcare on nutrient utilization and growth performance of sheep during the early or late dry season 3. Emerging feed markets for ruminant production in urban and peri-urban areas of Northern Ghana | | | | | | Online publication  Tropical Animal Health and Production  Tropical Animal Health and Production | | | | | | Dec. 2017  Dec. 2017  Dec. 2017 | |
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| 7. Sustainable intensification indicators | | | | | | | | | | | | | |
| 7.1 Productivity | | | | Crop and animal production at the plot, farm and household levels | | | | | | | | | |
| 7.2 Environmental | | | | Soil health at the farm and household levels | | | | | | | | | |
| 7.3 Economic | | | | Profitability and input use efficiency at the plot farm and household levels | | | | | | | | | |
| 7.4 Social | | | | Gender equity | | | | | | | | | |
| 7.5 Human | | | | Production of nutritious food at the plot and farm level  Consumption of nutritious food at household level  Nutrition awareness at the household levels | | | | | | | | | |

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| 8. How will scaling be achieved? |  |
| Scaling up nutrition and agricultural interventions entails identifying those programs and practices of proven efficacy and applying management, communications, and monitoring principles and tools to expand the number of beneficiaries until everyone who requires the product or service is reached. During the process of scaling-up, given resource constraints and as a good management practice, it is often necessary to prioritize groups that have a more urgent need (in this case the most undernourished children).  The main platforms through which nutrition interventions can be scaled up are health systems (where government is usually in the lead and the private sector also has a role) and food systems (where the private sector is most active but government has an important role to play). In this regard, we shall work with Ghana Health Services in disseminating key research outputs on the nutritional benefits, particularly on pregnant women and children (6-36 months) of the livestock and vegetable production interventions by this study. As research outputs are expected from Year 2 of the study, we envisage that the dissemination activities will start in Year 2. In addition, to Ghana Health Services, we shall also engage NGOs working on nutrition education in scaling the outputs from this study.  Findings from the study will provide insights into how prenatal food-based interventions can positively influence postnatal growth through women empowerment in agriculture production of ASF. It is therefore expected that any positive finding will be scaled-up through key stakeholders such as the Ministries of Health and Agriculture. | |
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| 9. How are the activities in this protocol linked to those of others? | |
| Linked to protocol GH111A-17 and GH111B-17. | |

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| 10. Budget (USD) | | | | |
| Budget Line | ILRI | UDS | WorldVeg |  |
| Personnel | 39,000 | 6,600 | 3,000 |  |
| Services | 15,000 | 5,000 | 1,500 |  |
| Supplies | 25,000 | 1,900 | 1,500 |  |
| Capital | 0 |  | 1,000 |  |
| Travel | 10,744 | 3,000 | 1,750 |  |
| Overhead (17.5%) | 15,256 | 3,500 | 1,750 |  |
| Total | 105,000 | 20,000 | 10,000 |  |

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| **2017 Africa RISING West Africa Activity Protocol – Outcome 2: GH221-17** | | | | | | | | | | | |
| *Outcome 2: More farmers and farm families are adopting technologies and practices to improve nutrition, food and feed safety, post-harvest handling and value addition.* | | | | | | | | | | | |
| a. Output: 2.2 | Post-harvest technologies and practices to provide options for the food, and feed sectors are tested and disseminated to farmers, through researchers, extension staff, and development partners | | | | | | | | | | |
| b. Activity: 2.2.1 and 2.2.2 | Introduce, evaluate, adapt and disseminate existing post-harvest technologies and practices; and build capacity of farm families to reduce post-harvest losses | | | | | | | | | | |
| c. Sub-activity: GH221-17 | Reducing post-harvest losses in stored grains of cereals and legumes | | | | | | | | | | |
| d. Research team | | | | | | | | | | | |
| *Name* | | | *Institution* | | | *Role* | | | | | |
| Adebayo Abass | | | IITA | | | Post-harvest studies | | | | | |
| Bekele Kotu | | | IITA | | | Economic studies) | | | | | |
| Kofi Danso | | | IITA | | | Post-harvest management | | | | | |
| Abdul Rahman Nurudeen | | | IITA | | | Agronomy | | | | | |
| Gundula Fischer | | | IITA | | | Gender studies | | | | | |
| Kipo Jimah | | | IITA | | | Gender studies | | | | | |
| Shaibu Mellon | | | IITA | | | Economics studies | | | | | |
| Issah Sugri | | | SARI | | | Post-harvest management | | | | | |
| Mutari Abdullai | | | SARI | | | Post-harvest management | | | | | |
|  | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | |
| Name | | | | Institute | | | Degree | | Start | | End |
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| f. Location(s) | | | 13 communities (5 NR, 5 UWR, 3 UER) | | | | | | | | |
| g. Start | | | April 2017 | | | | | | | | |
| h. End | | | September 2019 | | | | | | | | |
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| 1. Justification | | | | | | | | | | | |
| The post-harvest system consists of the delivery of a crop from the time and place of harvest to the time and place of consumption, with minimum loss, maximum efficiency and maximum return to all involved (Spurgeon, D., 1976[[14]](#footnote-14)). It encompasses a sequence of activities and operations that can be divided into technical (harvesting, shelling, field drying, threshing, cleaning, additional drying, storage, processing); and economic (transporting, marketing, quality control, nutrition, extension, information and communication, administration and management) activities.  Post-harvest losses occur between harvest and the moment of human consumption. They include on-farm losses, such as when grain is threshed, winnowed and dried, as well as losses along the chain during transportation, storage and processing. Important in many developing countries, particularly in Africa, are on-farm losses during storage, when the grain is being stored for auto-consumption or while the farmer awaits a selling opportunity or a rise in prices.  Limited post-harvest research was undertaken by the Africa RISING West Africa project in Mali and Ghana in Phase 1. It focused on the comparison of jute sack, PICS bag and GS4 sacks either with or without protectants (Actellic Super EC and phostoxin); and the effect of hermitic plastic tanks with or without grain protectants. There is need to compare farmers' silos with modified farmers' silo (improved) and GS4 silos bags (e.g., 1 ton capacity). New methods for drying must also be compared and demonstrated, and study both biophysical and socio-economic factors affecting adoption of improved postharvest practices by farmers.  Farmers are at great risk of losing significant amounts of their harvest and consequently their income, due to their inability to properly store their grain - cereals (maize) and legume (cowpea and groundnut). Most farmers have limited knowledge on stored-grain management. Current farmer threshing and shelling practices lead to breakage. Poor sorting and drying lead to pest and disease infestation, high percentages of foreign matter, and high moisture content that can cause mycotoxin contamination. Storage is often done in homes using traditional silos and jute bags, without adequate protection from pests or routine fumigation leading to low grain quality. There are a number of innovative shelling, drying and storage technologies available, but these are yet to reach and/or be adapted/adopted by farmers, traders and government agencies involved in food storage due to technical and socio-economic reasons. There is need to train farmers, extension agents and researchers on stored-grain management, especially with respect to, maize, cowpea and groundnut. Building individual and institutional capacities in post-harvest research and development will be embedded in all activities under this protocol.  Adding value to crop and livestock products to improve quality and market value is limited at the household and community levels. Where value addition is practiced (e.g., milk-processing; soybean processing, etc.) in the intervention communities, it is mostly done by women using traditional, outmoded, and time consuming methods which increase the work-load of women and result in low-quality products with limited shelf-life.  Socio-economic and biophysical activities will be implemented with public and private sector partners to evaluate and demonstrate best practices for reducing post-harvest losses in maize, cowpea and groundnut. Small-scale, post-harvest labor-saving machinery (shellers, fodder choppers) and post-harvest products (e.g., Super Grain Bags, PICS bags, Collapsible Dryer Case and Sil bags) will be evaluated against farmers' current practice in the Africa RISING intervention communities in the three regions. Male and female farmers' preferences, labor and time saved by the introduction of a technology will be recorded. Cost-benefit ratio of using the technology will be determined.  Equal numbers of female farmers and male farmers will be considered when selecting farmers for field trials. Female AEAs with outstanding field performances will be given priority and selected for training workshops to on their turn train farmers in best post-harvest practices. Further, female experts in the field of post-harvest research in Ghana and elsewhere will be invited from time to time as consultants to assist with the implementation and, female students with interest in research on post-harvest management will also be given equal priority as male students for further training.  The protocol covers activities 2.2.1 and 2.2.2 in the Africa RISING West Africa Project Phase 2 logframe. | | | | | | | | | | | |
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| **Sub-activity GH221-1701: Exploring willingness to pay for small scale maize shelling machines - Leader: Bekele Kotu** | | | | | | | | | | | |
| Mechanization is an important complement, and in some cases a necessary condition, to agricultural intensification. It constitutes several implements and machines which can substitute or supplement human labor to carry out energy/power intensive operations (such as land preparation, harvesting and threshing) as well as control intensive operations (such as planting and weeding) (Pingali, 2007[[15]](#footnote-15)). While agricultural mechanization played a great role during the Asian green revolution, current scholarly opinions indicate that mechanization can play even a better role to intensify African agriculture because of the fact that land-to-labor ratio is relatively high in many African countries such as Ghana, Tanzania, Nigeria, Senegal, and Zambia (Nin-Pratt and McBride, 2014[[16]](#footnote-16)). That is, when existing land has to be more intensively cultivated, mechanization will be adopted to complement the higher labor demand to accomplish increased activities. Secondly, there are also arguments that agricultural operations are arduous by their nature and mechanization is necessary to reduce the drudgery. Drudgery has increasingly become important to explain the opportunity cost of labor, particularly for the youth, who can otherwise be engaged in less laborious urban based employments although they may be less productive (Mrema et al., 2008[[17]](#footnote-17)). Most of the laborious activities such as manual threshing are usually carried out by women and hence the adoption of mechanization may improve the welfare of women. Thirdly, the adoption of mechanization can also reduce harvest and postharvest grain losses. For instance, a study indicates that the use of a combine harvester could reduce grain losses by 20-35 percent as compared to manual threshing (Hassena et al., 2000[[18]](#footnote-18)).  Despite these potential advantages of mechanization, humans are the main power source for agricultural production in sub-Saharan Africa (Diao et al., 2016[[19]](#footnote-19)). Until recently the use of engine-powered machines has been limited to a few countries in this region and where mechanized farms exist they are definitely large-scale commercial farms. In fact, smallholder farmers who contribute to the large part of the total production in these countries are out of reach of mechanization. This can be partly attributed to the failure of state-led mechanization schemes in several African countries in the 1970s and 1980s due to lack of demand among farmers (Pingali, Bigot, and Binswanger, 1987[[20]](#footnote-20)). Nevertheless, evidence indicates that situations are changing and the demand for mechanization may have begun to emerge in some parts of Africa in recent years, promoting a renewed focus on mechanization (Mrema et al., 2008). The demand for mechanization emerges at a point when it becomes cost-effective to use it instead of other available options. Thus, policy and development interventions aimed at promoting mechanization must first confirm whether sufficient demand for mechanization is present.  Small motorized maize shelling machines increase the labor efficiency among smallholder farmers while saving costs. Initial results of our earlier study in northern Ghana show that farmers can save on average 36 hours per ton of maize shelled if they use the diesel operated machine instead of the manual method they are using at present. They can save about 28 hours if they use electric operated machines. The time saved is equivalent to 40 GHS and 30 GHS per ton for the diesel and electric shellers, respectively. These results show that the potential demand for the technologies will be high if the machines are promoted. However, there is no concrete evidence on how much farmers are willing to pay for the new technologies and which factors affect the level of payments. Therefore, this study is initiated to fill this gap. Scientific evidence on farmers’ willingness to pay and associated factors is useful particularly to stakeholders operating on the supply side of the market. | | | | | | | | | | | |
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| 2. Objectives | | | | | | | | | | | |
| * 1. To create awareness on the maize shelling machines among small scale farmers | | | | | | | | | | | |
| * 1. To quantify how much farmers are willing to pay for the maize shelling machines (or their services) if the market makes the machines (or their services) available to them | | | | | | | | | | | |
| * 1. To identify factors affecting willingness to pay among the farmers | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | |
| 3.1 How much are farmers willing to pay for the machines or their services? | | | | | | | | | | | |
| 3.2 What are the factors influencing farmers’ willingness to pay for the machines or their services? | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | |
| The study will involve a household survey which will be conducted in August 2017. It will cover a total of 600 households in 13 communities. The purpose of this survey is to assess the willingness of the farmers to pay for the machines and their services. Data will be collected on the amounts farmers are willing to pay, household demography, labor use, income and assets, maize production, experience in mechanization (including maize shelling machines) and others. In addition to the household surveys, key informant interviews will be conducted with 2-3 agric-machinery dealers and at least one agricultural expert in the study districts. The purpose of key informant interviews is to explore the supply chains for agric-machineries and associated policy environment. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | | | Responsibility/Institute | | | |
| Data will be collected on farmers’ willingness to pay for maize shelling machines, household demography, labor use, income and assets, maize production, experience in mechanization (including maize shelling machines) and others | | | | | | | | Bekele Kotu/IITA | | | |
|  | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | |
| Deliverables | | | | | Means of verification | | | | | Date | |
| 6.1 Awareness created among farmers on maize shelling machines | | | | | Attendance reports of demonstration event and pictures the events | | | | | Apr. 2017 | |
| 6.2 Instruments developed and programmed | | | | | Sample of instrument available | | | | | Jul. 2017 | |
| 6.3 Second survey completed | | | | | Reports and completed survey questionnaire | | | | | Aug. 2017 | |
| 6.4 Data cleaned and initial results reported | | | | | Poster, Technical report | | | | | Sep. 2017 | |
|  | | | | | | | | | | | |
| 7. Sustainable intensification indicators | | | | | | | | | | | |
| 7.1 Productivity | | Shelled output per unit of labor input and time per household | | | | | | | | | |
| 7.2 Environmental | |  | | | | | | | | | |
| 7.3 Economic | | Cost per unit of output, cost saved per unit of output, stated demand | | | | | | | | | |
| 7.4 Social | | Participation rate by gender, labor saved by gender | | | | | | | | | |
| 7.5 Human | | Drudgery score | | | | | | | | | |
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| **Sub activity GH221-1702: Evaluate and demonstrate options to reduce post-harvest losses in stored cereal and legumes - Leader(s): Adebayo Abass and Asamoah Larbi** | | | | |
| 2. Objectives | | | | |
| 2.1 Compare and demonstrate different storage methods ( e.g., silos, hermetic plastic tanks) | | | | |
| 2.2 Compare and demonstrate different drying methods | | | | |
| 2.3 Document gender preferences for postharvest technologies and practices | | | | |
|  | | | | |
| 3. Research questions/hypotheses | | | | |
| 3.1 Post-harvest losses in cereal and legume grains are significantly affected by storage and drying methods | | | | |
| 3.2 Male and female farmers have similar preferences for post-harvest storage and drying | | | | |
|  | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | |
| On-farm trials will be conducted to evaluate, adapt and disseminate storage technologies to reduce post-harvest losses in stored grain, especially maize, groundnut and cowpea. Most of the on-farm studies will use a randomized complete block design (RCBD) with communities as blocks and households as replicates, and farmers’ current practices as controls. The trials will be conducted in 6 communities with 10-20 households per treatment based on the size of the community over 12-18 months period. Data to be collected every two months will include: pest infestation, volume per weight loss, quality losses (physical, biochemical, nutritional, economic), aflatoxin levels and farmers’ perceptions. Capacities of farm families and development partners will be strengthened to reduce post-harvest losses. | | | | |
| **Sub-activity GH221-1702-1: On-farm comparison of storage technologies to prevent stored-product insect infestation of maize - Leaders: Adebayo Abass, Asamoah Larbi and Kofi Danso** | | | | |
| 1. Actellic Super treated maize in 50 kg polyethylene bags (poly sacks)  2. Untreated maize in 50 kg polypropylene (PP) bags and  3. Untreated maize in 50 kg Super Grain Bags (GrainPro)  4. Untreated maize in 50 kg PICS bags | | | | |
|  | | | | |
| **Sub-activity GH221-1702-2: On-farm evaluation and demonstration of silos for grain storage: Leader(s): Adebayo Abass, Asamoah Larbi and Kofi Danso** | | | | |
| 1. Farmer’s silo  2. Modified farmer’s silo  3. 1-ton GS4 Silo bags | | | | |
|  | | | | |
| **Sub-activity GH221-1702-3: Evaluate, adapt and disseminate driers - Leader(s): Adebayo Abass, Asamoah Larbi and Kofi Danso** | | | | |
| New post-harvest products will be purchased and demonstrated with farmers' practices as control. Potential products to be evaluated include:  1. Super Grain Bags (SGB IV-R)  2. Collapsible Dryer Case  3. Sil bags | | | | |
|  | | |  | |
| 5. Data to be collected and uploaded | | | Responsibility | |
| 5.1 Pest infestation | | | IITA/SARI | |
| 5.2 Volume per weight loss | | | IITA/SARI | |
| 5.3 Quality losses | | | IITA/SARI | |
| 5.4 Aflatoxin levels | | | IITA/SARI | |
|  | | | | |
| 6. Milestones | | | | |
| Deliverables | | Means of verification | | End date |
| 6.1 A post-harvest team is established | | Field visit and project report | | Apr. 2017 |
| 6.2 Post-harvest options identified | | Project reports | | Apr. 2017 |
| 6.3 Communities are identified trial inputs purchased | | Project reports | | Jul. 2017 |
| 6.4 Post-harvest trials established | | Field visits project reports | | Oct. 2017 |
| 6.5 At least 300 farmers exposed to new options | | Project report and field visit | | Aug. 2017 |
| 6.5 Peer reviewed paper: "Comparison of post-harvest storage methods for cowpea and maize grains" | | Journal of stored products | | Mar. 2019 |
|  | | | | |
| 7. Sustainable intensification indicators | | | | |
| 7.1 Productivity | Crop yield at the farm and household levels | | | |
| 7.2 Environmental | Pesticide use at the household level | | | |
| 7.3 Economic | Profitability and input use efficiency at the farm and household levels | | | |
| 7.4 Social | Gender equity at the farm and household levels | | | |
| 7.5 Human | Production of nutritious food and food production at the household level | | | |

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| 8. How will scaling be achieved? | | | |
| Farmers' field days will be organized to create awareness among farmers about the post-harvest technologies and practices; ensuring the supply and/or availability of the technologies and practices; facilitating credit for the purchase of the technologies and practices; and encouraging farmers’ groups to be engaged in the provision of services related to the technologies and/or practices. | | | |
|  | | | |
| 9. How are the activities in this protocol linked to those of others? | | |  |
| Linked to protocols GH111A-17 and GH111B-17. | | | |
|  | | | |
| 10. Budget (US$) | Sub-activity GH221-17012 | Sub-activity GH221-17021 | |
| Personnel | 18,000 | 76,000 | |
| Services | 2,000 | 52,000 | |
| Supplies | 2,000 | 28,000 | |
| Capital | 0 | 0 | |
| Travel | 3,500 | 14,000 | |
| Overhead | 0 | 0 | |
| Total | 25,5002 | 170,0001 | |
| 1Includes cost of staff, project offices, vehicle running and maintenance of the 25 intervention communities in the Northern (Tamale), Upper West (Wa) and the Upper East (Navrongo) regions.  2 Budget assigned separately by Project Manager to project socio-economist, and therefore not included in the consolidated budget. | | | |

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| **2017 Africa RISING West Africa Activity Protocol – Outcome 3: GH311-17** | | | | | | | | | | | |
| *Outcome 3: Farmers and other value chain actors have greater and equitable access to production assets and markets (input and output) through enabling institutions and policies.* | | | | | | | | | | | |
| a. Output: 3.1 | | | Enabling policies and institutional arrangements to increase participation of farm families, especially women and youth in the output and input markets and decision-making are advocated for implementation by national governments, policy makers and development partners | | | | | | | | |
| b. Activity: 3.1.1 | | | Review existing policies and institutional arrangements affecting equitable access to production assets and markets | | | | | | | | |
| c. Sub-activity: GH311-17 | | | Review and compile gaps and dysfunctionality in SI policies and institutions (norms, rules and practices) of SI at target areas and enhance farmer access to credit and markets | | | | | | | | |
|  | | |  | | | | | | | | |
| d. Research team | | | | | | | | | | | |
| Name | Institution | | | | | | Role | | | | |
| Charity Osei | STEPRI | | | | | | Policy analysis | | | | |
| Clara Anim Nyarkoah | FOSTERING | | | | | | Establishment of cooperatives and linkages to markets | | | | |
| Bekele Kotu | IITA | | | | | | Economic evaluation | | | | |
| Jimah Kipo | IITA | | | | | | Gender analysis | | | | |
| Shaibu Mellon | IITA | | | | | | Economic evaluation | | | | |
| Joab Darkwa | FOSTERING | | | | | | Field supervision and research | | | | |
| Emmanuel Awuni | FOSTERING | | | | | | Cooperative Development | | | | |
|  | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | |
| Name | | Institute | | | | Degree | | | Start | End | |
|  | |  | | | |  | | |  |  | |
|  | | | | | | | | | | | |
| f. Location(s) | | Duko (Northern), Nyangua (Upper East) and Zanko(Upper West) | | | | | | | | | |
| g. Start | | May 2017 | | | | | | | | | |
| h. End | | Dec. 2018 | | | | | | | | | |
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| 1. Justification | | | | | | | | | | | |
| Policy and institutional contexts influence the success of scaling-up projects. It is therefore crucial to first understand the different formal policy and informal local institutional contexts to be able to formulate strategic dissemination and scaling-up/out models to ensure sustainable adoption of the generated sustainable intensification technologies and practices. The research findings will also provide inputs for the formulation and adoption of national agricultural policies, and how to reorganize local market institutions with a focus on the use of sustainable agricultural intensification approaches to address food insecurity in Northern Ghana.  Access to financial services is critical to provide funds for farm investments in productivity, improve post-harvest practices, smooth household cash flow, enable better access to markets and promote better management of risks. Access to finance can also play an important role in climate adaptation and increase the resilience of agriculture to climate change, thus contributing to longer term food security. Access to a comprehensive range of financial services is a significant challenge for smallholders, who constitute the vast majority of farmers in the three northern regions.  Farmers’ decisions to invest and to produce are closely influenced by access to financial instruments. If appropriate risk mitigation products are lacking, or if available financial instruments do not match farmers’ needs, farmers may be discouraged to adopt better technologies, to purchase agricultural inputs, or to make other decisions that can improve the efficiency of their businesses. Improving access to finance can increase farmers’ investment choices and provide them with more effective tools to manage risks. We want to ascertain whether access to finance would influence adoption of the technologies promoted by Africa RISING. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | |
| 2.1 Identify gaps in existing agricultural policies (with focus on sustainable intensification), and diagnose the institutional conditions prevalent in markets and adoption of new technologies | | | | | | | | | | | |
| 2.2 Assess the impact of credit provision to adoption of the technologies promoted by Africa RISING | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | |
| 3.1 What SI policies exist in the current national agricultural policy document, what are the gaps and dysfunctionalities; and what institutional conditions (norms, rules and practices) exist in the target areas, input and output markets and how do these contexts influence households/farmers adoption of SI packages? | | | | | | | | | | | |
| 3.2 Does access to credit contribute to adoption of the technologies promoted by Africa RISING? | | | | | | | | | | | |
| 3.3 What factors influence farmers’ decisions on loan allocations? | | | | | | | | | | | |
| 3.4 What factors influence the demand for credit? | | | | | | | | | | | |
| 3.5 What is the role of farmer based organizations in farmers’ access to credit? | | | | | | | | | | | |
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| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | |
| **Sub-activity GH311-1701: Review and compile gaps and dysfunctionality in SI policies and institutions (norms, rules and practices) of SI at target areas - Leader: Charity Osei** | | | | | | | | | | | |
| Desk review of national agricultural policies, to be triangulated with key informants and personal interviews. A survey designed to capture gender-disaggregated and farmer types data will be conducted, and validated with key informants, personal interviews, participant observations and focus group discussions | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **Sub-activity GH311-1702: Enhancing farmer access to credit and markets - Leader(s): Clara Nyarko** | | | | | | | | | | | |
| The study will be conducted in nine Africa RISING intervention communities, three from each region. It will involve focus group discussions and individual interviews to collect gender-disaggregated data on the role of credit access to adoption of technologies promoted by the Africa RISING project. Three treatments will be used:  (i) Farmers who have access to credit only;  (ii) Farmers who have access to credit with training on financial literacy;  (iii) Control ( i.e., farmers who do not have access to neither credit nor training)  The treatment will be assigned to households in two stages:  Stage 1: 9 Communities (3 from each region) will be assigned to treatments randomly  Stage 2: One Household will be sampled randomly from each of the nine communities. All sample households will take the treatment assigned to their community. Assignment of the treatment to each household would depend on whether or not that household fall within the treatment categories stated above | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | | | Responsibility/Institute | | | |
| 5.1 Secondary and primary quantitative and qualitative data on policy gaps and dysfunctionality; enabling/constraining institutional conditions | | | | | | | | STEPRI | | | |
| 5.2 Secondary and primary quantitative and qualitative data on credit accessibility and its impact to adoption of the technologies promoted by Africa RISING | | | | | | | | FOSTERING | | | |
|  | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | |
| Deliverables | | | | Means of verification | | | | | | | Date |
| 6.1 Policy gaps, dysfunctionalities and local institutional conditions reviewed | | | | Interview guides; tape recorded and transcribed information and pictures and videos, project technical and financial reports | | | | | | | Aug. 2017 |
| 6.2 Report on effect of access to credit and markets on adoption | | | | Uploaded report on CKAN | | | | | | | Dec. 2017 |
| 6.3 Paper in edited proceedings - 'Gaps in policies and institutions affecting sustainable intensification' | | | | Paper in edited workshop proceeding | | | | | | | Dec. 2018 |
|  | | | | | | | | | | | |
| 7. Sustainable intensification indicators | | | | | | | | | | | |
| 7.1 Productivity | | | | |  | | | | | | |
| 7.2 Environmental | | | | |  | | | | | | |
| 7.3 Economic | | | | | Profitability and input use efficiency at farm and household level | | | | | | |
| 7.4 Social | | | | | Gender equity at farm and household level | | | | | | |
| 7.5 Human | | | | |  | | | | | | |

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| 8. How will scaling be achieved? |
| Scaling will be achieved by first identifying agricultural based (particularly those with stakes in sustainable intensification) development partners, private and public sector organizations; then disseminating insights and success stories from research findings through knowledge-sharing events; getting buy-in; and facilitating communities of practice activities to enhance adoption and implementation of findings in diverse context. |
|  |
| 9. How are the activities in this protocol linked to those of others? |
| Linked to protocols GH111A-17, GH111B-17, GH321-17 and GH4123-17. The activities in this protocol mainly focus on markets, institutions, policies and adoption of new SI technologies. These activities link directly to most others which seek to generate new SI technologies and practices. In that sense, our activities will help to unravel insights on how the generate technologies and practices are adopted, within what contexts, and how access to input and output markets are achieved. Mostly, the activities will lead to forming alliances to promote scaling up of technologies generated from other activities. |

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| 10. Budget (USD) | | |
| Budget Line | STEPRI | FOSTERING |
| Personnel | 5,000 | 3,000 |
| Services | 5,000 | 4,000 |
| Supplies | 4,000 | 0 |
| Capital | 3,000 | 0 |
| Travel | 5,000 | 2,000 |
| Overhead | 3,000 | 1,000 |
| Total | 25,0001 | 10,0002 |
| 1,2Contract STEPRI for US$ 35,000. STEPRI to disburse US$ 10,000 to FOSTERING | | |

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| **2017 Africa RISING West Africa Activity Protocol – Outcome 3: GH312-17** | | | | | | | | | |
| *Outcome 3: Farmers and other value chain actors have greater and equitable access to production assets and markets (input and output) through enabling institutions and policies* | | | | | | | | | |
| a. Output: 3.1 | Improved policies and institutional arrangements to increase participation of farm families, especially women and youth in the output and input markets and decision-making are advocated for implementation by national governments, policy makers and development partners | | | | | | | | |
| b. Activity: 3.1.2 | Assess the level of inclusiveness of women and the youth along crop and livestock value chains | | | | | | | | |
| c. Sub-activity: GH312 | Explore value chain options engaged in by men, women and the youth | | | | | | | | |
| d. Research team | | | | | | | | | |
| Name | Institution | | | Role | | | | | |
| Kipo Jimah | IITA | | | Leader | | | | | |
| Gundula Fischer | IITA | | | Member | | | | | |
| Prince Kwesi Otabil | IITA | | | Member | | | | | |
|  | | | | | | | | | |
| e. Student(s) | | | | | | | | | |
| Name | | Institute | | | Degree | | Start | | End |
| 1. | |  | | |  | |  | |  |
| 2. | |  | | |  | |  | |  |
| 3. | |  | | |  | |  | |  |
|  |  | | | | | | | | |
| f. Location(s) | 6 project communities (Zanko and Goriyiri in UWR, Botigoli and Cheyohi in NR, Nyangua and Tekuru in UER) | | | | | | | | |
| g. Start | April 2017 | | | | | | | | |
| h. End | February 2018 | | | | | | | | |
|  |  | | | | | | | | |
| 1. Justification | | | | | | | | | |
| Development of agricultural value chains is being considered a priority for transforming smallholder agricultural production systems (IFPRI, 2007)[[21]](#footnote-21). A value chain describes the full range of activities in the production process that are required to bring a product or service from conception through the intermediary phases of production and delivery to final consumers (Kaplinsky and Morris, 2000)[[22]](#footnote-22). Rubin et al (2008)[[23]](#footnote-23) describe value chain analysis as the process of documenting and analyzing the operation of a value chain. This involves the mapping of chain actors and calculating the value added to a product along the chain. For Riisgaard et al (2010)[[24]](#footnote-24), a value chain analysis provides the opportunity for actors in a production process to understand each other’s functions and the activities involved and to identify and correct barriers and gaps that cause inefficiencies in the production process.  While value chain analysis is not new, integrating gender in value chain analysis is more recent (Kruijssen et al. 2016)[[25]](#footnote-25). In Ghana, women occupy an important place in agricultural production. Women are engaged in various activities in the production and distribution process including adding value to the product and the provision of logistical support to ensure the product reaches the end user. It is reported that women constitute 52% of agricultural labor, 70% in food crops productions, 95% in agro processing, and 85% in food distribution (SEND-Ghana, 2014)[[26]](#footnote-26). Yet, women are often not considered ‘visible actors’ in the agricultural production chain. Gender issues need to be integrated in value chain analysis for the purpose of understanding women’s and other population subgroups’ position in a value chain, the effect of changes in a value chain on gender inequality and the main constraints for women in terms of gaining from value chain participation (Mutua, E. et al. 2014)[[27]](#footnote-27).  Under phase 1 of Africa RISING, limited value addition to improve quality in crops and livestock products at the household and community level in Northern Ghana was reported. For this reason the need for research on post-harvest and value addition has been emphasized in phase 2 (IITA, 2016, phase 2 proposal, pg. 10)[[28]](#footnote-28). As Africa RISING continues to support farmers to increase agricultural production through the introduction of technologies, it is important to understand the activities of all actors and the relationship between various actors in the production and distribution, as well as the control and use of benefits that accrue from participating in the production and distribution processes (Kruijssen et al. 2016).  Coles and Mitchell (2011)[[29]](#footnote-29) identify the potential of a value chain approach to analyze men and women’s participation at every stage of agricultural value chains and that a gendered value chain analyses should include intra-household and institutional level analysis (Coles and Mitchell, 2011). The research will adopt a gender transformative value chain analysis approach. A gender transformative value chain analysis approach will provide an understanding of crops and livestock value chains opportunities available in the project communities, reveal the effects of social norms that create inequalities between men and women within and across the various stages in a value chain, the nature and barriers to entry that constrain the ability of women and the youth to use existing crops and livestock value chains opportunities to build their livelihoods. Part of this research will be awareness creation not only to improve women’s access to resources but also to help communities to understand and challenge the social norms that create inequalities between men, women and the youth. | | | | | | | | | |
| 2. Objectives | | | | | | | | | |
| 2.1 To explore value chains options engaged in by men, women and the youth in project communities | | | | | | | | | |
| 2.2 To assess the opportunities, constraints and needs of men, women and the youth in participating in one selected value chain | | | | | | | | | |
|  | | | | | | | | | |
| 3. Research questions | | | | | | | | | |
| 3.1 What are the different value chains in project communities that men, women and youth participate in? | | | | | | | | | |
| 3.2 What are the opportunities, constraints and needs of men, women and the youth in participating in one value chain to be selected? | | | | | | | | | |
| 3.3How are the opportunities, constraints and needs gendered in this particular value chain? | | | | | | | | | |
| 4. Procedures | | | | | | | | | |
| The study will use both qualitative and quantitative approaches. Desk review of relevant documents, a rapid appraisal and discussions with NGOs will be conducted to gain an overview on value chains options. The results of the overviews will inform the development of an interview guide for focus group discussions with men, women and the youth on a selected value chain. The data from the overview and FGD will inform the development of questions for individual interviews (360 individual interviews, 60% female) and key informant interviews. There will be a feedback and it will take two forms. The first feedback will comprise of relevant actors and selected individuals from R4D platforms to validate the results. The second will be communitywide sensitization on gender equality issues that will incorporate the results of the study in the research communities targeting 300 participants (60% females).  A list of Africa RISING project beneficiaries in sampled communities will constitute the sample frame. A random sampling process will be used to select 60 households as the primary sample and 24 households as a secondary sample. Three household members, the household head, the spouse and an adult member of the household preferably a youth (a person of 15-35 years (GOG/MY&S, 2010[[30]](#footnote-30))) will be interviewed. In the case where it is female-headed household, a male and a female will be interviewed in addition to the household head. In a situation where there are no additional household members to be interviewed, a household from the secondary sample be used.  Key informants will be identified through deskwork and during rapid appraisal in the selected communities. | | | | | | | | | |
|  | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | Responsibility/Institute | | | |
| 5.1 Secondary and primary quantitative and qualitative data | | | | | | Kipo Jimah, IITA | | | |
|  | | | | | | Research assistants from UDS | | | |
|  | | | | | | | | | |
| 6. Milestones | | | | | | | | | |
| Deliverables | | | Means of verification | | | | | Date | |
| 6.1 Desk review by Kipo Jimah | | | Interview guide, transcribed notes on consultations | | | | | Apr./May 2017 | |
| 6.2 Scoping trip to surveys communities carried out, study instrument developed and consultations with NGOs on value chain development held by Kipo Jimah | | | Interview guide, transcribed notes on scoping trip, study instruments | | | | | Jun. 2017 | |
| 6.3 Conduct focus group discussions by Kipo Jimah and Prince Otabil | | | Transcribed notes | | | | | Jul. 2017 | |
| 6.4 Enumerators recruited and trained by Kipo Jimah and Gundula Fischer | | | Advert, training module, attendance | | | | | Aug. 2017 | |
| 6.5 Crops and livestock values chains in surveyed communities mapped; constrained and needs assessed by Kipo Jimah and Prince Otabil | | | Transcribed notes, pictures; data sets from administered questionnaires | | | | | Sep. 2017 | |
| 6.6 Validation meeting held by Kipo Jimah and Prince Otabil | | | Validation meeting report | | | | | Oct. 2017 | |
| 6.7Employfindings from research to create awareness on gender equality issues to be led by Kipo Jimah and Prince Otabil | | | Report on community awareness training | | | | | Nov./Dec. 2017 | |
| 6.8 Study report written by Kipo Jimah, Prince Otabil and Gundula Fischer | | | Poster, Technical report | | | | | Feb. 2018 | |
|  | | | | | | | | | |
| 7. Sustainable intensification indicators | | | | | | | | | |
| 7.1 Productivity | |  | | | | | | | |
| 7.2 Environmental | |  | | | | | | | |
| 7.3 Economic | | Market participation by gender | | | | | | | |
| 7.4 Social | | Gender equity- access to resources for participation in value chain | | | | | | | |
| 7.5 Human | |  | | | | | | | |

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| 8. How will scaling be achieved? | Through the community awareness creation on gender equality using findings of the research. Also use of R4D platforms and project engagements with farmers and partners |
|  | |
| 9. How are the activities in this protocol linked to those of others? | The activity in this protocol is linked to activities under the outcome 3--improved policies and institutional arrangements to increase participation of farm families, especially women and youth in output and input markets and decision-making. For the West African project, a similar study will be conducted in the Koutiala area in Mali. |

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| 10. Budget1 (USD) | |
| Budget Line | Amount |
| Personnel | 6,375 |
| Services | 3,400 |
| Supplies | 810 |
| Travel | 5,400 |
| Overhead | 0 |
| Total | 15,985 |

**1** Budget will come from Africa RISING Gender Specialist’s WA budget cc5839

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| **2017 Africa RISING West Africa Activity Protocol – Outcome 3: GH321-17** | | | | | | | | | |
| *Outcome 3: Farmers and other value chain actors have greater and equitable access to production assets and markets (input and output) through enabling institutions and policies.* | | | | | | | | | |
| a. Output: 3.2 | | | Output 2: Options to increase access to production assets and increase participation in decision-making by women, youth and other vulnerable groups | | | | | | |
| b. Activity: 3.2.1 | | | Identify constraints to and opportunities for increasing women and youth access to production assets/decision making in the target area | | | | | | |
| c. Sub-activity: GH321-17 | | | Analyze intra-household differences and decision-making for adoption | | | | | | |
|  | | |  | | | | | | |
| d. Research team | | | | | | | | | |
| Name | | Institution | | | Role | | | | |
| Jeroen Groot | | WUR | | | Farming systems analysis (Activity Leader) | | | | |
| Katrien Descheemaeker | | WUR | | | Farming systems analysis | | | | |
| Carlo Azzari | | IFPRI | | | Typology analysis | | | | |
| Bekele Kotu | | IITA | | | Economic analysis | | | | |
| Gundula Fischer | | IITA | | | Gender assessment | | | | |
| Kipo Jimah | | IITA | | | Gender assessment | | | | |
|  | | | | | | | | | |
| e. Student(s) | | | | | | | | | |
| Name | | Institute | | | Degree | | Start | End | |
| Thibault De Moor | | WUR | | | MSc | | 2017 | 2017 | |
| Mirja Michalscheck | | WUR | | | PhD | | 2014 | 2018 | |
|  | |  | | |  | |  |  | |
|  | |  | | | | | | | |
| f. Location(s) | | Duko (Northern Region), Nyangua (Upper East ), Zanko (Upper West) | | | | | | | |
| g. Start | | February 2017 | | | | | | | |
| h. End | | December 2017 | | | | | | | |
|  | |  | | | | | | | |
| 1. Justification | | | | | | | | | |
| The second phase of Africa RISING is about scaling up ‘successful technologies’. For scaling up it is important to know the target farms and farmers, since farming systems are diverse and not all technologies are equally suitable for each farm household and their household members. We know that different household members have different roles and interests (production orientation) as well as power positions (assertiveness). Interests and power positions, together, result into farm decisions. Together, all farm decisions result into one specific farm configuration (land and labor allocation, cropping pattern) per season. Hence, each farm configuration is associated to a certain degree of satisfaction for each household member. A change in farm configuration may benefit one household member and adversely affect another. We currently do not understand well the intra-household trade-offs associated to alternative farm designs for sustainable intensification. This piece of information is an innovative and highly valuable addition to the exploration of technical possibilities (alternative farm configurations) as determined in the whole-farm model Farm DESIGN. Since Africa RISING wants women and children to benefit from their technologies (improved agronomic practices), we argue that a deeper look into the household is indispensable to understand scaling possibilities as well as possible impacts per technology. | | | | | | | | | |
|  | | | | | | | | | |
| 2. Objectives | | | | | | | | | |
| 2.1 Identify individual curves of satisfaction (per household member) associated to different farm configurations, mainly land allocation to different crops. Show intra-household trade-offs | | | | | | | | | |
| 2.2 Quantify and explain differences among different household members concerning their ‘curves of satisfaction’ | | | | | | | | | |
| 2.3 Make use of typologies e.g. by comparing the technical and social performance of different traction methods per farm type in Duko (Northern Region) and Nyangua (Upper East Region) | | | | | | | | | |
|  | | | | | | | | | |
| 3. Research questions | | | | | | | | | |
| 3.1 What are the intra-household trade-offs associated with alternative farm designs for sustainable intensification? | | | | | | | | | |
| 3.2 Do different household members evaluate the different AR technology packages differently? If yes: on what aspects do perceptions differ? And what can be concluded for technology targeting/scaling? | | | | | | | | | |
|  | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | |
| 4.1 Individual (and separate) farmer interviews with minimum one female and one male adult per case study household (n=9 households). Method: a gaming approach with leafs or pebbles serving to express the degree of satisfaction (ranging from 0-10, 0= not satisfied; 10= highest satisfaction possible). The approach has been tested during field visit in August 2016. | | | | | | | | | |
| 4.2 For contextualization: further interviews of same style (>5 per farm type in each case study community) to check for patterns per farm type. | | | | | | | | | |
|  | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | Responsibility/Institute | | | |
| 5.1 Per variable (e.g. land allocation to maize) we capture one ‘range of values’ (expressing satisfaction) per household member. The results of all household members will be ‘pooled’ in one Excel table and the results will jointly be presented in a line chart. Further visualizations may be added. Data for all variables, all households and household members will be made available to AR colleagues on CKAN. Data must not be fully unlocked/used by anyone else than the authors until published in a peer reviewed journal article | | | | | | Mirja Michalscheck/WUR | | | |
|  | | | | | | | | | |
| 6. Milestones | | | | | | | | | |
| Deliverables | | | | Means of verification | | | | | Date |
| 6.1 Journal article: Model results versus farmer realities. Operationalizing diversity within and among smallholder farming systems for a nuanced impact assessment | | | | Submitted for publication | | | | | Dec. 2017 |
| 6.2 Master Thesis (WUR) | | | | Uploaded document | | | | | Aug. 2017 |
|  | | | | | | | | | |
| 7. Sustainable intensification indicators | | | | | | | | | |
| 7.1 Productivity | Crop and livestock yield at the farm and household levels | | | | | | | | |
| 7.2 Environmental | Soil health at the farm and household level | | | | | | | | |
| 7.3 Economic | Profitability and input use efficiency at the household level | | | | | | | | |
| 7.4 Social | Gender equity at the farm and household levels | | | | | | | | |
| 7.5 Human |  | | | | | | | | |
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| 8. How will scaling be achieved? |  | |
| Existing typologies (e.g. Signorelli, 2016[[31]](#footnote-31)) may serve to broadly test the validity of identified intra-household patterns per farm type. Knowledge about intra-household differences (and trade-offs) may sensitize/improve ongoing scaling efforts, minimizing intra-household trade-offs. | | |
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| 9. How are the activities in this protocol linked to those of others? | |  |
| Linked to protocols GH111A-17 and GH311-17. | | |

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| 10. Budget (USD) | |
| Budget Line |  |
| Personnel | 15,000 |
| Services | 2,000 |
| Supplies | 1,000 |
| Capital | 0 |
| Travel | 2,500 |
| Overhead | 4,500 |
| Total | 25,0001 |
| 1Contract WUR | |

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| **2017 Africa RISING West Africa Activity Protocol – Outcome 4: GH4123-17** | | | | | | | | | | | | | | |
| *Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI technologies, innovations and practices.* | | | | | | | | | | | | | | |
| a. Output: 4.1 | | | Alliances and effective partnerships developed between farmers, local communities, and research and development agents in the public and private sectors to enable the release, dissemination, and adoption of proven technologies and practices to scale | | | | | | | | | | |
| b. Activity: 4.1.2&3 | | | Map and assess relevant stakeholders to establish dialogue for the exploration of mutual synergies for scaling delivery of validated technologies.  Leverage/link and integrate (engagement and outreach) with existent initiatives including Government extension systems to support and encourage the delivery pathways | | | | | | | | | | |
| c. Sub-activity: GH4123-17 | | | Promote partnerships for large-scale delivery of technologies/practices | | | | | | | | | | |
| d. Research team and scaling partners1,2 | | | | | | | | | | | | | | |
| *Researchers* | | | | *Institution* | | *Role* | | | | | | | | |
| Asamoah Larbi | | | | IITA | | Partnership establishment and coordination of activities | | | | | | | | |
| Isaac Kankam Buadu | | | | ADRA | | Partnership establishment and scaling | | | | | | | | |
| Charity Osei | | | | STEPPRI | | Policies and institutions | | | | | | | | |
| Abdul Nurudeen | | | | IITA | | Cereal agronomy and plant nutrition | | | | | | | | |
| Shaibu Melon | | | | IITA | | Economic analysis | | | | | | | | |
| Kipo Gimah | | | | IITA | | Gender studies | | | | | | | | |
| Kofi Danso | | | | IITA | | Post-harvest management | | | | | | | | |
| Saaka Buah | | | | SARI | | Plant nutrition and soil science | | | | | | | | |
| 1National development partners: ACDEP, CFC, CRS, INSTI, RING, ADVANCE II, ATT, Urban Network, TRIAS Ghana, ProNet, Project, AMSIG Marketing Company, Food Security through Cooperative in Northern Ghana Project, Savanna Agricultural Development Agency, MTN-Ghana, Vodaphone-Ghana, Farm Radio International, Local Councils, District Assembly, Regional Coordination Councils, Rural Bank, Agricultural Development Bank, Gees Fresh Point, Poultry Farmers Association (Bolga, Wa and Tamale), Vision Farms, Parliamentarians, Input Dealers, Animal Breeding Stations (Kpong Tamale, Paga, Babile), Seed Producers Association of Ghana, Animal Production Division, Veterinary Services, Grains and Legumes Development Board, Youth Harvest | | | | | | | | | | | | | | |
| 2International development partners: Adventist Development and Relief Agency , Farm Radio International, Aga Khan Foundation, CARE International (Ghana), Plan Ghana, Grameen Foundation, Catholic Relief Services, Social Enterprise, Netherlands Development Organization, World Food Program, World Vision, Camfed, Canada Funds for Children, Oxfam. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | |
| Name | | | | | Institute | | | | Degree | Start | | End | | |
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|  |  | | | | | | | | | | | | |
| f. Location(s) | Africa RISING intervention communities in Northern, Upper East and Upper West regions; and communities of Africa RISING partners involved in scaling-out technologies | | | | | | | | | | | | |
| g. Start | June 2017 | | | | | | | | | | | | |
| h. End | March 2018 | | | | | | | | | | | | |
|  |  | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | |
| In Phase 1, country-based regional/district coordination teams implemented generic research on technology identification, testing, and validation in partnership with district and community-based research-for-development platforms primarily consisting of disciplinary experts in the public sector and farmers. Ad hoc dissemination and scaling arising from technology generation and demonstration activities targeted a few (less than 5,000) direct beneficiaries who were engaged in the technology development/validation resulting in high cost per beneficiary. Monitoring and evaluation was mostly quantitative, with no beneficiary tracking system to capture formal / informal technology dissemination.  Phase 2 proposes to disseminate proven technologies and practices from Phase 1 in collaboration with development partners to reach more than 90,000 households. Thus, there is need to develop briefs to describe the technologies and practices developed in Phase 1; expand the multi-stakeholder partnerships to include more private sector and development actors; establish multi-stakeholder interest groups for specific SI innovations at the community and district levels; build the capacity of the partners for scaling-out the technologies/practices; scale-out the SI innovations with the development partners and interest groups; and develop a tracking system capture the beneficiaries.  This protocol covers activities 4.1.2, 4.1.3 and 4.4.1 in the Phase 2 project logframe (Table 1). It builds on the ad hoc technology dissemination and scaling-out/up in Phase 1. Budget for activities under this protocol will be derived from the dissemination budget. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | |
| 2.1 To identify stakeholders engaged in agricultural development and agribusiness in the project area and explore potential for partnership in research-in-development | | | | | | | | | | | | | | |
| 2.2 To facilitate institutional arrangements and partnerships at the community, district and regional levels for technology dissemination | | | | | | | | | | | | | | |
| 2.3 To identify proven technologies and practices from Phase 1 that can be scaled-out in Phase 2, and develop technology briefs to describe them | | | | | | | | | | | | | | |
| 2.4 To build capacity of stakeholders to disseminate validated technologies and/or practices to thousands of households | | | | | | | | | | | | | | |
| 2.5 To review existing scaling-out/up models or pathways and institutional arrangements to reach out to thousands of households | | | | | | | | | | | | | | |
| 2.6 To establish knowledge-sharing and learning alliances among scaling actors | | | | | | | | | | | | | | |
| 2.7 To facilitate large-scale use/adoption of technologies identified in Phase 1 | | | | | | | | | | | | | | |
| 2.8 To develop a monitoring systems to track and capture beneficiaries | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 3. Scaling /issues | | | | | | | | | | | | | | |
| 3.1 Who are the potential public and private sector research-in-development partners in the project area; and which of them have the potential to deliver validated technologies and practices to thousands of households? | | | | | | | | | | | | | | |
| 3.2 What type(s) of partnership and institutional arrangements could be initiated to ensure effective scaling-up/out of the validated technologies and practices, especially reaching out to women and youth? | | | | | | | | | | | | | | |
| 3.3 What are the validated technologies and practices identified from Phase 1 that can be scaled-out in Phase 2? | | | | | | | | | | | | | | |
| 3.4 What scaling models/pathways exist, and which will be appropriate for the various technologies and practices? | | | | | | | | | | | | | | |
| 3.5 What strategies can be used to strengthen their capacities to disseminate technologies and/or practices to thousands of beneficiaries? | | | | | | | | | | | | | | |
| 3.6 How can primary and secondary beneficiaries be tracked to ensure targets are reached? | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **Sub-activity GH4123-1701: Promote multi-stakeholder partnerships for technology development and dissemination - Leader(s): Asamoah Larbi et al.** | | | | | | | | | | | | | | |
| Mapping of potential research and development partners for engaging in Phase 2 of the WA project which started in Phase 1 will continue. Potential partners identified during the initial mapping (see Table 5 of the WA Phase 2 project proposal), and new ones will be visited to discuss partnership arrangements for scaling-out/up technologies.  Mobilization, sensitization and documentation of beneficiary households in the intervention communities which started during Phase 1 will continue in all the regions. Five new communities in Binduri district will be identified and mobilized. The existing list of beneficiary households in each community will be updated and geo-referenced. New beneficiary households will be enlisted. Community-based organizations, women's interest groups, and youth associations in each community and their objectives will be documented.  The research-for-development platforms implemented at the community and district levels will be replaced by multi-stakeholder interest groups for a specific SI innovation at the community and district levels (see Table 3 in the WA Phase 2 proposal). The partners and interest groups will be used to identify and disseminate validated technologies and practices, promote knowledge sharing and dissemination, and establish knowledge-sharing and learning alliances among scaling actors. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **Sub-activity GH4123-1702: Identify and describe validated technologies - Leader(s):- Asamoah Larbi et al.** | | | | | | | | | | | | | | |
| The Chief Scientists will circulate the WA project template for technology description to all scientists and activity leaders for the second time in May 2017 for them to describe their validated technologies and/or practices in Phase 1, as well as any other proven technologies/practices that can be scaled-out in Phase 2. The Chief Scientist will send the completed technology description templates for expert review. Thereafter, the briefs will be forwarded to the Communication Specialist for review and publishing. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **Sub-activity GH4123-1703: Scale-out validated technologies with multiple partners - Leader(s): Asamoah Larbi et al.** | | | | | | | | | | | | | | |
| Validated technologies in the Guinea Fowl and Maize-Legume (cowpea, soybean and groundnut) rotations and intercropping (Table 2) will be disseminated under the leadership of ADRA. A 2-day expert workshop will be organized in each of the three regions to: 1) present and discuss where and how each of the validated technologies can be disseminated; 2) agree on models/pathways, partnerships and institutional arrangements for scaling out the SI technologies and practices; 3) identify capacity building needs and strategies to build the capacity of partners to scale out the technologies; and 4) how the beneficiary households can be monitored. Regional Training-of-Trainers workshops will be organized based on the identified training needs.    Partnership with the N2 Africa, and Cowpea and Groundnut Scaling projects to demonstrate and disseminate improved varieties and management practices on cowpea, groundnut and soybean will be strengthened to reach out to households beyond the Africa RISING project intervention communities. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **Sub-activity GH4123-1704: Promote knowledge sharing for dissemination of technologies - Leader(s): Asamoah Larbi et al.** | | | | | | | | | | | | | | |
| Several strategies will be used to promote knowledge sharing and dissemination among scaling actors. This will include: 1) establishment of knowledge sharing and learning alliances among scaling actors at the community and district levels; 2) the Community-based Technology Park approach initiated by the WA project in Ghana and adapted in Mali; 3) radio and TV discussions; 4) development of media materials, e.g. posters, leaflets and films; 5) promotion of interest groups for specific technology or practice, especially women's groups and youth associations; 6) linking and/or integrating with existing initiatives, e.g. the 'Grow-for-jobs Initiative' to promote the cereal (maize, sorghum and millet) and legume (cowpea and soybean) value chains and the School Feeding Program of the Ghana Government. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **Sub-activity GH4123-1705: Defining recommendation domains for Africa RISING validated technologies - Leader(s): Asamoah Larbi et al.** | | | | | | | | | | | | | | |
| The scale of implementation of the WA project varies with activity in each country. It ranges from the plot to farm/field scale or from household to the community level. Most of the activities are implemented at the plot or field levels. Nevertheless, results and output from the activities can be extrapolated to larger scales and bigger recommendation domains using modeling, Geographical Information Systems (GIS) and Remote Sensing Technique. For example, preliminary GIS analysis showed that results from plot activities implemented at the Natodori intervention community in the Upper West Region can be applied to other West African countries with similar agro-ecology and socio-economic environment.  In Phase 2, Decision Support Systems will be used to match the agronomic (fertilizer application, crop densities, planting dates, crop combinations) and livestock related technologies and practices to soil and climatic conditions for sustainable intensification of the cropping and livestock production systems, and to address production variability and risk in northern Ghana. This sub-activity is partly in response to the recommendations of the USAID-commissioned external evaluation team in Phase 1. The activity will be undertaken in collaboration with the GIS and Remote Sensing Unit of the University of Ghana and the IITA GIS Unit. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | | | Responsibility | | | | | | |
| 5.1 Number of beneficiary households | | | | | | | | IITA and scaling partners | | | | | | |
| 5.2 Number of national and international scaling actors | | | | | | | | IITA and scaling partners | | | | | | |
| 5.3 Number of proven technologies | | | | | | | | IITA and scaling partners | | | | | | |
| 5.4 Number of interest groups and association | | | | | | | | IITA and scaling partners | | | | | | |
|  | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | |
| Deliverables | | | | | | | Means of verification | | | | End date | |
| 6.1 Revised list of intervention communities | | | | | | | Technology briefs | | | | Jul. 2017 | |
| 6.2 Updated list of beneficiary households | | | | | | | Project reports | | | | Jul. 2017 | |
| 6.3 At least 3 technology briefs | | | | | | | Project reports | | | | Aug. 2017 | |
| 6.4 Knowledge sharing alliance in 4-6 communities | | | | | | | Project reports | | | | Nov. 2017 | |
| 6.5 Report of scaling partners workshop | | | | | | | Project reports | | | | Nov. 2017 | |
|  | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators | | | | | | | | | | | | | | |
| 7.1 Productivity | |  | | | | | | | | | | | | |
| 7.2 Environmental | |  | | | | | | | | | | | | |
| 7.3 Economic | |  | | | | | | | | | | | | |
| 7.4 Social | | Gender equity and equity for youth and marginalized groups at the household level | | | | | | | | | | | | |
| 7.5 Human | | Capacity to experiment at the farm and household level | | | | | | | | | | | | |
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| 8. How will scaling be achieved? |
| Scaling will be achieved through strategic partnership with development partners. |
|  |
| 9. How are the activities in this protocol linked to those of others? |
| Activities in this protocol are linked to those on all the other protocols because it promotes partnerships for the implementation and dissemination of the research and development activities. |

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| 10. Budget (USD)1 | |
| Budget Line |  |
| Personnel | 15,000 |
| Services | 20,000 |
| Supplies | 20,000 |
| Capital | 0 |
| Travel | 15,000 |
| Overhead | 0 |
| Total | 70,000 |
| 1The budget for this protocol is not included in the consolidated budget in Table 2. Because, it is assumed that funds for this protocol will be allocated from the budget for dissemination which is different from research. Funds will be allocated by IITA to partners based on their responsibilities in each of the sub-activities. | |

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| **3: Consolidated budget in USD (x1,000)** | | | | | | | | | | | | | |
| Activity protocol | Leader | IITA | ILRI | IWMI | CIAT | WorldVeg | WUR | MOFA | STEPPRI | UDS | CCAFS | FOSTERING | Total |
| **Outcome 1: Productive, resilient and sustainable crop-livestock systems** | | | | | | | | | | | | |  |
| Integrated crop-livestock production | IITA | 3801 |  |  |  | 30 |  | 10 |  |  | 10 |  | 430 |
| Aflasafe development | IITA | 30 |  |  |  |  |  |  |  |  |  |  |  |
| Water resources management | IWMI |  |  | 70 |  |  |  |  |  |  |  |  | 70 |
| Land and soil resources management | CIAT |  |  |  | 50 |  |  |  |  |  |  |  | 50 |
| **Outcome 2: Improved nutrition, food safety, post harvest handling and value addition** | | | | | | | | | | | | | 0 |
| Nutrition-sensitive agriculture | ILRI |  | 105 |  |  | 10 |  |  |  | 20 |  |  | 135 |
| Post-harvest management | IITA | 1702 |  |  |  |  |  |  |  |  |  |  | 170 |
| **Outcome 3: Enabling policies and institution for equitable access to production assets and markets** | | | | | | | | | | | | | 0 |
| Farming systems | WUR |  |  |  |  |  | 25 |  |  |  |  |  | 25 |
| Policies, institutions and markets | STEPRRI |  |  |  |  |  |  |  | 25 |  |  | 10 | 35 |
| **Outcome 4: Partnerships to endure delivery and uptake of sustainable innovations at scale** | | | | | | | | | | | | | 0 |
| Promote partnerships for scaling of innovations | IITA3 |  |  |  |  |  |  |  |  |  |  |  | 0 |
| Sub-total |  | 580 | 105 | 70 | 50 | 40 | 25 | 10 | 25 | 20 | 10 | 10 | 945 |
| Grand total |  |  |  |  |  |  | 945 |  |  |  |  |  |  |

1Includes 20,000 USDfor graduate training;

2Does not include the 25,500 USD which will be paid directly

3Estimated budget not included because it is assumed that protocol will be funded from funds allocated for dissemination.

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